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ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXVIII. No. 3288 NOVEMBER 29, 1940 SIXPENCE

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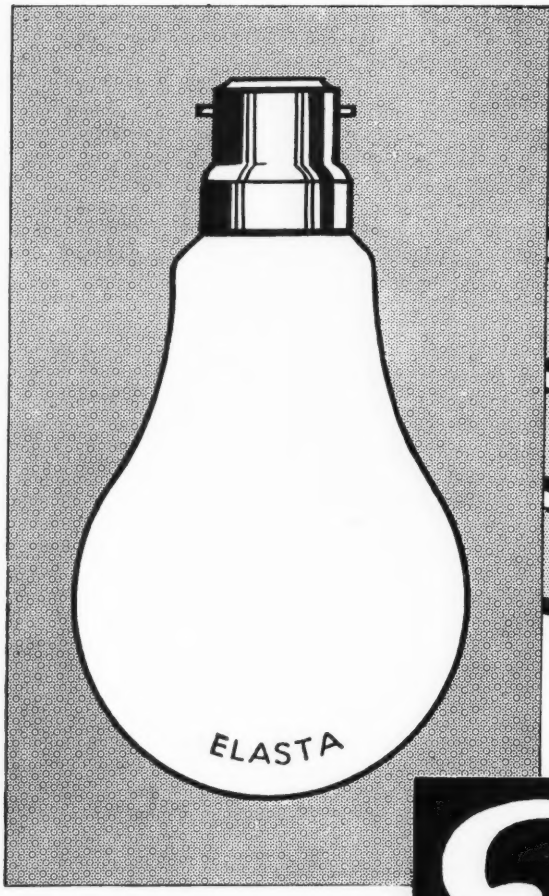

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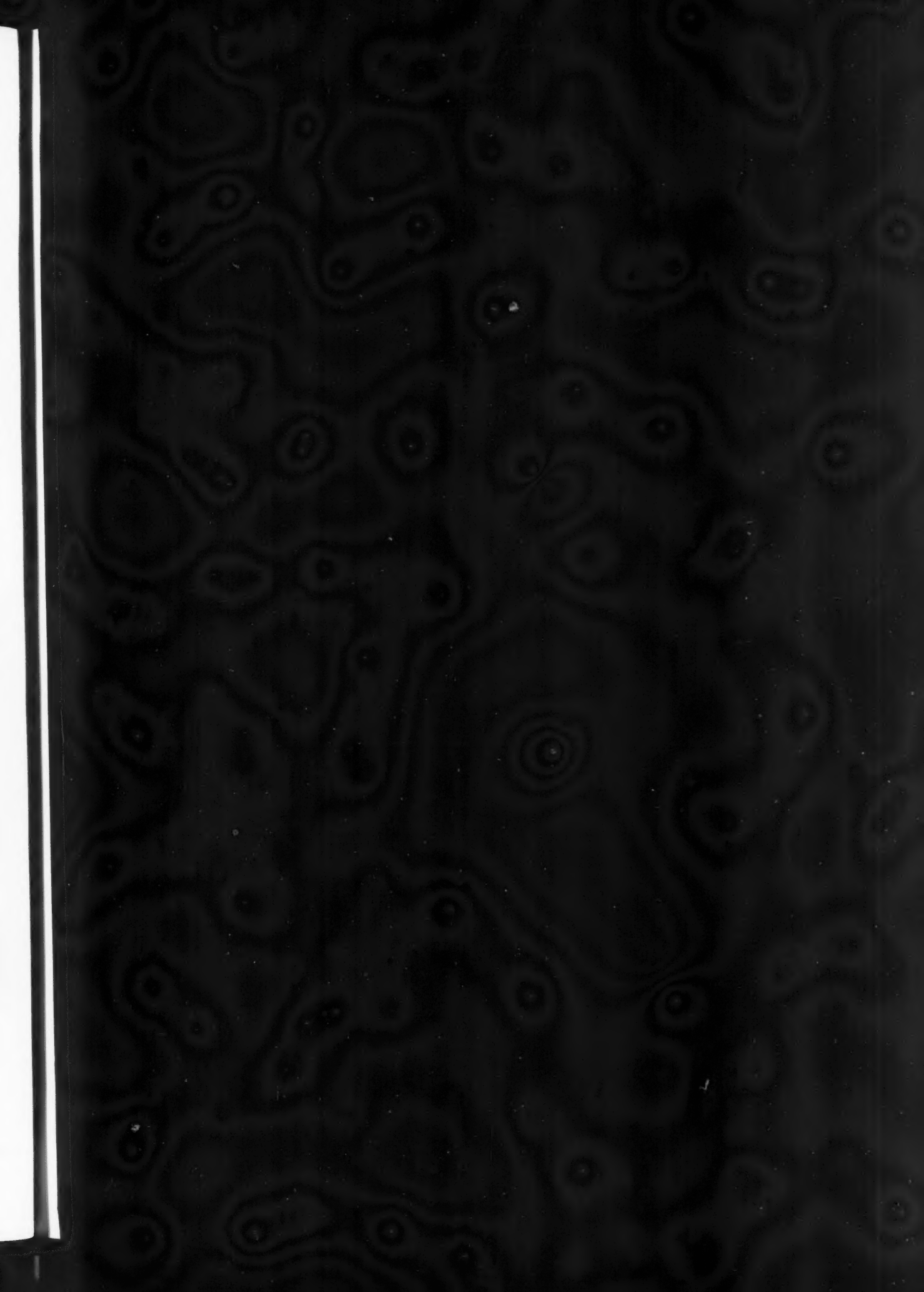

THE ELECTRICAL REVIEW

Volume CXXVIII — No. 3288

Friday, November 29th, 1940

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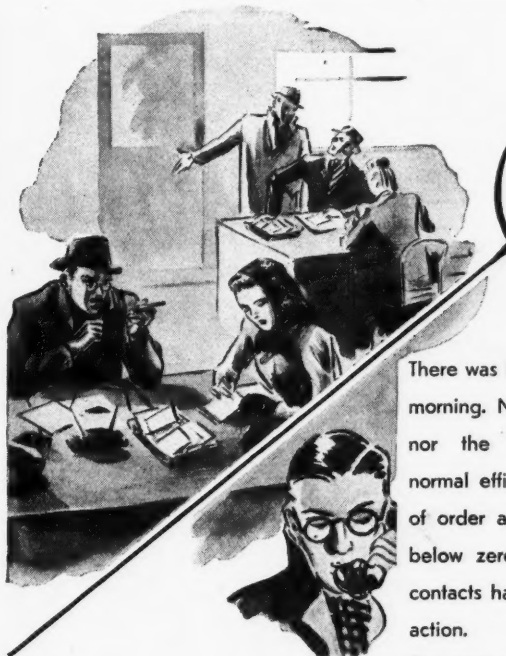

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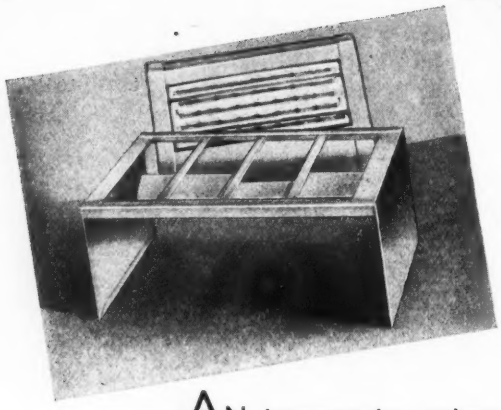

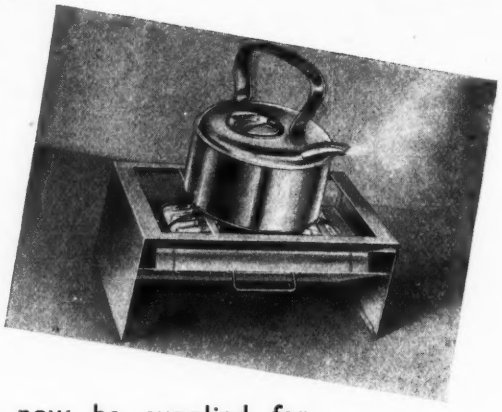

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THE
ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER —— ESTABLISHED 1872

Vol. CXXVIII. No. 3288 NOVEMBER 29, 1940 Price SIXPENCE

Safety in the Home

Protecting the Domestic Consumer

THE safety of workers or the general public is ostensibly the first consideration in framing regulations governing the use of electricity. In this respect, however, regulations that relate to the domestic sphere compare unfavourably in effectiveness with those for factories and mines, which have the weight of statutory authority behind them. Whatever the extent of the compulsive powers that may be justified in the interests of employees, it is inherently much more difficult to legislate for the protection of the individual against misuse of electricity in his own home. The latter aspect has come to the fore recently in connection with the amateur wiring of air-raid shelters, a matter which has been engaging the attention of the Electrical Development Association and was the subject of a warning which was recently broadcast by the B.B.C.

The Public's Trust

Those who persist in attempting to carry out installation work without the proficiency that is only to be acquired by appropriate hard training accept the risks consequent on their own foolhardiness. They are in very different case from consumers who, aware of their ignorance in electrical matters, put their trust (as, indeed, they ought to be able to do) in those whom they believe to possess the necessary knowledge. They are easily induced to buy attractive looking "gadgets" that seem to them to exemplify all that they have heard about the convenience and flexibility of electrical service. In the large majority of instances their confidence is fully justified, but this only emphasises the hazards introduced by exceptions that severely try the rule.

Many small appliances are employed for heating water, possibly in situations such as kitchens, bathrooms or air-raid shelters, that may be damp and are not entirely earth free. Some of these productions appear to demonstrate a naïve unawareness of the rough treatment meted out to domestic articles generally. Ordinary twin twisted flex is frequently used for the connecting leads of apparatus obviously intended to be used in steamy atmospheres.

The best that can be said about some of the rest is that they might not be dangerous, if the instructions usually supplied with them are closely followed, but surely that is too much to expect of all members of a family—and one mistake, if not serious in its consequences, is enough to discredit electricity as a reliable servant. Such appliances must be mistake-proof.

As an example we may take some forms of immersion heater of the electrode type that are being sold over the counter. There can be no certainty that these will not be placed in a metal pot, standing perhaps on a table close to an earthed cooker in a kitchen with a damp floor, or that the current will be switched off before removing the element from the liquid. Incidentally, no allowance is made for the possibility (unhappily, by no means remote) that the single-pole switch may be in the neutral wire. Moreover, it is difficult to shroud electrodes so as to avoid all possibility of the live parts being inadvertently touched while alive.

Unenforceable Regulations

It could be shown in detail how such appliances do not conform to the I.E.E. Regulations, but that would be irrelevant in the circumstances. These Regulations cannot be legally enforced, although compliance with them is implicity recommended in the Commissioners' Electricity Supply Regulations (one purpose of which is to secure the safety of the public) which permit, but do not require, undertakings to refuse to supply unsafe installations, subject to certain formalities, and undertakings have to take the chance of prosecution if they show too much zeal.

In any case, to appoint enough inspectors to see that all apparatus in use in homes is safe is as impracticable as it would be undesirable. The only workable scheme is to deal with the trouble at its source. The question of establishing a national proving centre to certify new appliances (after tests

under working conditions) has often been discussed in our columns. A not too elaborate organisation, representative of the electrical industry, would suffice to decide, subject to appeal to the Electricity Commissioners, whether the sale of any new device should be legally prohibited on grounds of safety.

The Farm

What was to have been the first paper presented before the Institution of Electrical Engineers in the present session is now available to its members. Appropriately it concerns electricity in agriculture—appropriately because electrical development for this purpose is officially recognised to be necessary in order to assist in increasing food production. Rural electrification in all its aspects provides an especially suitable subject for investigation by the Electrical Research Association and last week we reviewed a report of that body prepared by Mr. C. A. Cameron Brown. Mr. H. W. Grimmitt's I.E.E. paper may be regarded as opening a discussion on this report. For the time being the most urgent needs are to get over the limits to extensions imposed by scarcity and cost of materials and to concentrate on the labour-saving possibilities of electrical methods, *i.e.*, it is not always good enough merely to substitute an electric motor for some other source of power. These aspects were dealt with by Mr. Grimmitt in an article that appeared in our issue of June 7th, which should be studied in conjunction with the two documents mentioned above.

Whitleyism

It is generally conceded that the harmonious relationship which has existed for so many years between employers and men in the electricity supply industry is attributable to the efficient operation of the industry's Whitley Councils. It is therefore not pleasing to hear that the Worthing Corporation has declined to receive a deputation from the National Council on the subject of its withdrawal from the No. 11 District Council and that Chichester has not yet replied to a similar request. The National Council has decided to call the attention of the Ministry of Labour to the case of Worthing, in the hope, presumably, that the Minister will take action under the Conditions of Employment and National Arbitration Order. This, it will be remembered, empowers the Minister to compel employers to observe conditions laid down by properly constituted organisations representing employers and workers in an industry.

Earthing to Water Mains

For the effective earthing of electrical installations, the time-honoured method of connecting normally non-current carrying metal to water pipes (which dates from 1882) is still best. The question has often been raised as to how far this practice may cause damage to the water mains. This applies not only to the more obvious instances of electrolytic corrosion at points where DC leaves the pipes for the general body of earth, but also to the possibility of harm due to the partial rectification of AC. During the past year the American Research Committee on Grounding has investigated twenty-one cases, and reports that it has found no evidence of ill-effects due to AC. This, as the Committee admits, does not prove that such damage cannot occur. A most important point is that although individual leakage currents may be minute, the aggregate leakage current from a large AC system is appreciable, and if more than a very small proportion were rectified it might be injurious to buried metal. This aspect has been the subject of investigation by the E.R.A. over the last few years, but it will require time and patience before a definite conclusion can be reached and, if necessary, correctives devised.

Wartime Feeding

Although the chief purpose of the two new films produced by E.D.A. is to assist the Ministry of Food in its national campaign to encourage the wise use of food in wartime, a secondary result will be to further the appeal of electricity—quite rightly so, if we hold the true electrical faith. At this stage, when the idea of efficiency and practicability of electrical methods is widely accepted, the indirect approach made in the implied association of economical food preparation with electrical development is likely to be more effective in many cases than more obvious propaganda, necessary as that may still be in normal circumstances. The merits of the roundabout means are especially notable in the "Secrets of Life" film, the message of which is allowed to sink in while the thoughts of the audience are engaged for the time being with its features of considerable extraneous interest.

"Buy British" in Argentina

The British Community Council in Buenos Aires is conducting a vigorous "Buy British" campaign through the local Press and in other ways. The *Monthly Journal* of the British Chamber of Commerce in the Argentine Republic, in commenting on the campaign, says that there is actually an excess of demand over supply in the case of certain British-made articles, showing that the campaign is having immediate direct effects. Local importers are said to be aware of the trend and are acting accordingly. Possibly recent developments in connection with United States trade will react in our favour. Alarmed by the adverse balance shown by the recent trade figures, the Argentine authorities have put a brake on the issue of prior import permits for goods from the United States.

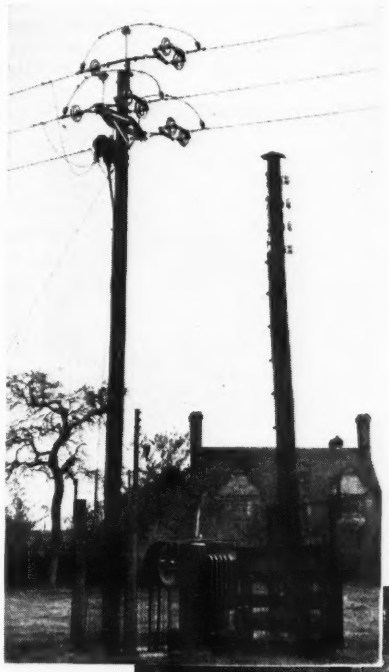
"Test" Results

A correspondent of the *Gas Times* has reported how a new convalescent home for soldiers in the north-west of England became "all-gas." He attributes the decision to the results of a number of tests which were made—where, when, how and by whom is not stated. The "score" was as follows, he says:—Cooking: Gas 18 points out of 20; electricity 10. Washing: Gas 15 points out of 20; electricity 11. Heating: Gas 14; electricity 12. Total: Gas 47; electricity 33. This is really too simple for readers of a journal of our contemporary's standing and no doubt its readers will press for further details. As the place in question was a military establishment, and as other cases quoted by the correspondent were Government buildings, we more than suspect the dead hand of the civil servant who has not yet discovered that things have changed a good deal in recent years. As we reported a week or two ago, E.D.A. is doing its best to bring Government Departments to a realisation of this change, but it is hard work.

MAKING RURAL SUPPLY PAY

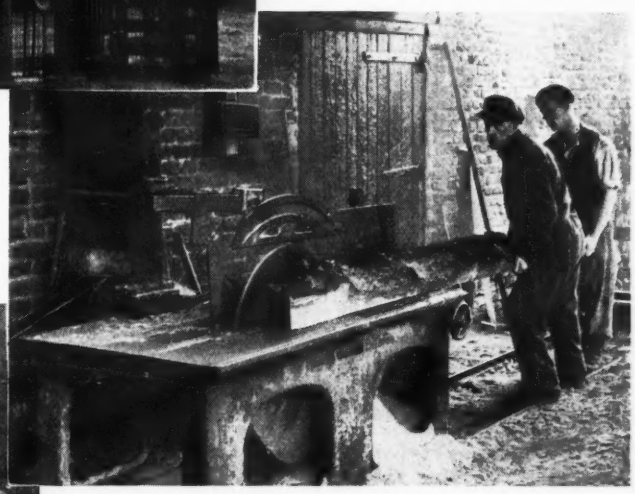
How the Problem has been Solved at Chester

WITH the increased necessity for the home production of food, farmers are faced with the problem not only of extending the land under cultivation which means that they have to obtain the requisite labour. The latter is now very difficult and will no doubt become increasingly so as the war proceeds. Although agricultural workers are included in the Schedule of Reserved Occupations, there is inevitably a drift of labour, especially on the part of the younger workers, away from the fields towards the higher-paid positions in factories. For this reason alone, apart from the many others, there is likely to be an ever-increasing demand for every mechanical means available which can assist in the smooth and efficient running of farms and minimise labour. This is where electricity can be of inestimable value and we foresee that electricity supply authorities with rural areas are going to have a busy time during the next few months providing all the facilities required.



Transformer and overhead lines supplying Mr. P. P. Walley's farm at Cotton Abbotts

Some undertakings may feel shy, in the present circumstances, of embarking on schemes which may on first consideration appear unremunerative or speculative, but, apart from the all-important question of national interest, there remains the fact that rural development is one of the few opportunities for expansion now permitted and also that quite a few authorities *are* succeeding in making it pay. One of the best examples of these is to be found at Chester, where well over half of the 1,600 agricultural holdings have now been connected to the supply, and it is accordingly of considerable interest and importance to inquire into the methods which Mr. S. E. Britton, engineer and manager of the City Electricity Department, and his staff have adopted to bring about this happy state of affairs.



This electrically driven circular saw is proving of great service at Messrs. William Wild & Son's farm, while Mr. A. W. Darlington finds that operations at his Tarvin Pool mill are much speeded up by the mixing machine shown on the left

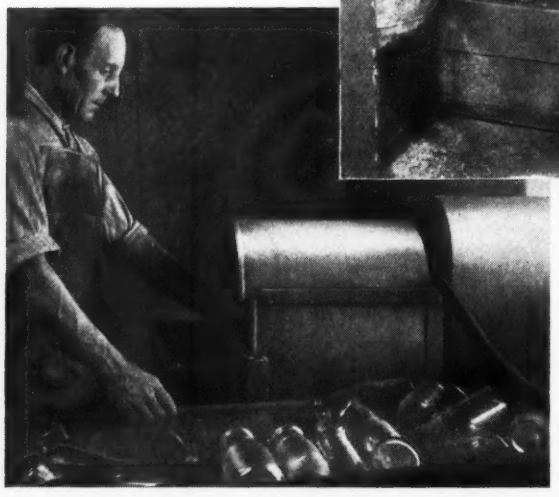
Besides claiming to have the most highly developed rural area in the world, Chester City Council also has the honour of being one of the first authorities to attempt the complete electrification of a rural area and it is all the more to its credit that it has succeeded in its object without the assistance of subsidies such as have been provided in the case of other extensive rural development schemes, notably those at Bedford and Norwich. Development of the country districts began in earnest about seventeen years ago, following the granting by the Electricity Commissioners in 1923 of a Special Order authorising the Council to supply in sixty-two square miles north, east and south of the city. Another Special Order made in 1927 authorised supply to seventy-seven square miles further east and south.

The area covered by the Chester undertaking amounts to 144 square miles, extending mainly to the south and east of the city, and of this all but six square miles may be regarded as rural. In this rural area the population is 31,952 and the number of premises 13,372. Up to March 31st last 8,757 premises (65.49 per cent.) in the rural area had been connected and during the year these consumed 12,947,728 kWh of electricity, an average of 1,478 kWh per consumer and 405 kWh per head of population. The revenue of £59,352 represented an average of £6.78 per consumer and 1.10d. per kWh sold, this figure including the supply to the West Cheshire Water Board's pumping station at Mouldsworth, which is supplied on a restricted basis of £2 per kW of maximum demand and 0.35d. per kWh, giving an average price of ½d. per kWh. Some villages may now be said to be 100 per cent. electrified and in many cases the use to which electricity is put is considerably

greater than in towns. Although the point is of little value under the existing wartime conditions, the presence of mains often serves as an inducement to builders to erect estates in the vicinity, the builders following the mains rather than vice versa.

As already mentioned, over half of the farms in the area take supplies, the actual figures being 862 out of a total of 1,597 with an acreage of 84,577. Of these 1,597 supplies are available for 1,222, so that it is apparent that over two-thirds of the farms take supplies where facilities are available. As might be expected, the larger the farm the greater is the likelihood that it is a consumer, so that while 56 per cent. of the farms between one and five acres to which supplies are available are connected, the percentage rises progressively until all eleven of the holdings of over 300 acres are consumers.

Altogether the farms account for nearly 3½ million kWh a year, representing an average consumption of almost 3,000 kWh. The revenue from this amounts to about £15,500, each holding contributing, therefore, an average of about £17 10s. The revenue per farm does not necessarily correspond directly with its size, for while the average revenues are £15.7, £17.1 and £19 respectively for holdings of 1–5, 5–20 and 20–50 acres, those for 50–100 and 100–150 acres are respectively £12.8 and £17.7. For farms of between 150 and 300 acres the revenue averages £27, that for those above 300 acres being £37.4.



Milk-bottle washing at Mollington Grange Farm and (above) whey separating at Cotton Abbotts Farm

These results have been achieved with the following tariff, which has incidentally had to be raised recently by an all-round increase of 20 per cent.:—Lighting: 6d. per kWh in the inner rural area and 6½d. per kWh in the outer area. Power: first 250 kWh per quarter, 2¼d. per kWh; second 250 kWh, 2d.; third 250 kWh, 1¾d.; above 750 kWh, 1½d. All-in tariff: a fixed charge of 17½ per cent. (inner area) or 20 per cent. (outer area) per annum of the net rateable value of the premises, plus 0.6d. per kWh. Water heating: ½d. per kWh. Over 95 per cent. of the electricity consumed under the above tariff is on the "all-in" tariff.

It has always been the policy of the Electricity Department to provide the utmost facilities for the consumer to acquire apparatus. Cookers, water heaters, washboilers and fires are all available on hire, while hire-purchase schemes spread over periods ranging from one to five years cover all classes of farm apparatus as well as the wiring installations. Members of the Department's staff are always available to advise farmers on any application of electricity, and the confidence and respect of consumers were quickly obtained in the initial stages of development by offering to install complete installations and reliable apparatus to fulfil definite functions, for a test period of six months, without payment, on the understanding that at the end of the test period the installation, having proved itself, would be purchased and taken over by the consumer. This policy, Mr. Britton tells us, has been particularly helpful, almost essential in fact, in developing new uses of electricity in the rural areas.

Taken as a whole, there is perhaps no more conservative class of person existing than farmers, though, once convinced of the advantages of new methods, there could be no better advocates. The utmost importance is therefore attached to the methods adopted in securing their interest and goodwill. Personal contact and prompt and efficient service appear to be the main essentials, and every individual member of the Department's staff is encouraged to spread the gospel of electricity wherever he may go and whatever duties he may be performing. Even wiremen who are not otherwise engaged assist new consumers or induce existing consumers to extend their use of electricity. This system has met with remarkable success, and, moreover, has the additional advantage that it nurtures a personal interest among the staff in the operation of the undertaking. Other methods of inducing farmers to adopt electrical methods are found to be of little avail.

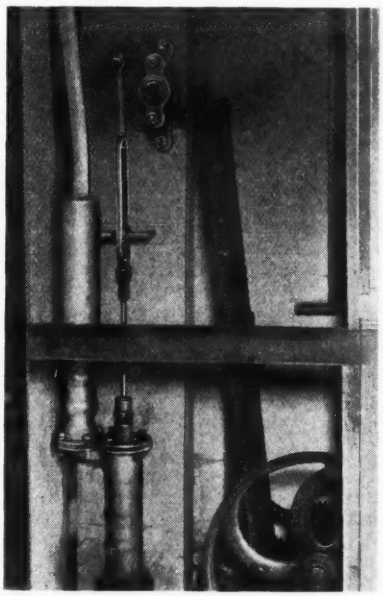
In the initial stages of development it is the practice of the Electricity Department to treat particular areas as a whole, and to obtain a nucleus of consumers without waiting for all the potential consumers to decide to take supplies. A few satisfied consumers do more than all the canvassing to help them make up their minds. Before granting a supply the Department asks for a guarantee of 20 per cent. of the capital expenditure involved, and this is allocated to each of the premises in proportion to the rateable values. It is thus expected that a scheme will become productive within three years. During these three years the very closest contact is kept with the consumers and every assistance is provided to ensure that plant and apparatus installed shall give them satisfaction.

In the preliminary dealings with prospective consumers the undertaking takes especial care not to underestimate the cost of giving the supplies. Farmers are generally business men and dislike intensely to feel that they have let themselves in for more than they expected. On the other hand, if their bills turn out to be smaller than they budgeted for, their attitude towards electricity automatically undergoes an improvement, an improvement which is reflected in the increased use of electricity not only by themselves but also by other farmers with whom they come into contact. The minimum guarantee also has the effect both of increasing electricity consumption and of adding to the amount of apparatus installed, since consumers who discover that they are not utilising sufficient energy to reach the minimum figure tend to become more lavish with their use or to install additional plant to make up for it. Seldom is it found that when the guarantee period is up the consumption declines.

As a result the extent and diversity of uses to which farmers now put electricity is exceptionally great. Indeed, we doubt whether there is another area in the country where farmers show themselves more willing or even anxious to try out new ideas or where there are more completely electrified farms. Actually over one hundred items are included in a list prepared for us by Mr. Britton detailing the various applications, and apart from the more stereotyped uses such as milking, sterilising, bottle washing and filling, food cutting and mixing, milling, pumping, incubating, etc., there are to be found less common electrical helps such as elevators and hoists, liquid manure pumps, spraying machines, straw balers, clarifiers and centrifuges, whitewashing machines, grass drying and hay curing apparatus, hedge trimmers, lawn mowers, farrowing heaters, etc., as well as a most comprehensive collection of household appliances. It seems that the farmer's wife is seeing to it that she is not left out of the advantages in labour saving and convenience that are made possible by electricity.

It is obviously impossible to refer individually to each one of the 820 farm installations in the area and we can hope to mention briefly only a very few we have had the opportunity of visiting, in order to indicate the extent to which the Department has succeeded in making its consumers electrically minded. One of the most enthusiastic and enterprising users is Mr. P. P. Walley, of Cotton Abbotts, Waverton, on whose farm of 320 acres approximately 64,000 kWh was accounted for last year. Every week he grinds 10 tons of corn and besides the mill he uses electricity both for bagging and hoisting. This year his grass-drying machine, which grinds and bales as well, has dealt with 250 tons of grass, while an electric fan and thermostatically controlled tubular heater installation have much simplified and improved cheese making.

Electricity has also made whey separating possible at Cotton Abbotts Farm and the cheese can be ground as soon as it is ready. A pump, cake mill, clipping machine, and stunning machine, are among the other farm equipment installed, and, although Mr. Walley is one of the few farmers we have met who does not approve of electric milking (possibly, we imagine, because he was one of the first users and the milking apparatus at that time had not been developed to the present degree of perfection), his dairy is otherwise highly electrified, with milk pump, refrigerator, bottlers, bottle washer, etc. Mr. Walley has also equipped his workshop with a number of electric tools, including a hammer and a drill, and has even gone so far as to install an electric " clocking-in " machine for the farm hands.



This electric pump is concealed behind the panelling in the hall of Barrow Hall Farm

In the farmhouse Mrs. Walley has at her disposal practically every domestic electrical device available—radiators, cooker, kettles, saucepans, hotplate, toaster, washing machine, irons, ironer, fans, vacuum cleaner, blanket, and clocks, and when we called at the farm Mr. Walley had just ordered another labour-saving device, namely, a dish-washing machine. Altogether the connected load of the farm is almost 60 kW.

A load of nearly 50 kW and an annual consumption of 17,000 kWh are represented by Mollington Grange Farm (405 acres), which is run by Mr. William Wild and his son. Here Mr. Wild, junior, is particularly enthusiastic about the advantages of electric pumping. About 20,000 gallons of water are required each day and all this is obtained by means of a pump operated by a 5-HP motor. The complete pumping installation cost £450 and the necessary energy consumed per quarter costs under £16, so that, as the accounts for water previously amounted to about £160 a year, there is a big saving. Another pump driven by a fractional HP motor caters for domestic supplies.

Experiments in vegetable and fruit drying have recently been carried out at Chester in connection with the National Food Campaign

The use of two milking outfits enables 140 cows to be milked three times a day by only four men ; without them at least ten men would be required. Mr. Wild, junior, also asserts that it is not possible to produce Grade A or T.T. milk without employing electricity for lighting the shippons. On this farm, too, besides the more customary corn mills, cake crushers, hoists, etc., the workshop is extensively electrified and there is in addition an electrically-driven circular saw which is proving of enormous value at present to provide timber for numerous farm requirements. Another piece of electrical apparatus which we have never before discovered on a farm is an adding machine in the office. A cooker, refrigerator, washing machine and ironer are among the extensive collection of domestic equipment. In all, the farm has about 300 lamps and twenty-two motors.

A 100-gal. thermostatically-controlled water heater, spray-painting equipment for treating farm machinery, and a pump concealed behind wood panelling in the hall of the farmhouse are interesting features of the next farm we visited, that of Mr. Blackburn at Barrow Hall, which with its dairy and barn machinery, portable motors, hay elevator, clipping machine, lighting, and domestic apparatus, has a connected load of about 30 kW and consumes about 8,500 kWh a year. At Great Barrow Mill, Mr. Alfred Willis used to have a 50-HP suction gas plant as auxiliary to 25-HP of water power. With this plant he was able to grind 2,500 tons of corn annually. The substitution of three electric motors totalling 105 HP for the suction gas plant has enabled him to increase his output to 6,000 tons.

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PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

WE reported in our October 11th issue the formation of Cable Makers (Australia) Pty., Ltd., to carry out the production of cables at Liverpool, N.S.W. It was recently announced that the directors of the new company are Sir Alexander Stewart, Sir George Julius, Mr. P. C. Holmes Hunt, Mr. J. W. Rutty and Mr. W. R. Caithness. Mr. A. L. Blake has been appointed general manager and Mr. H. Brain, secretary.

Mr. H. Winstanley (station superintendent) has been appointed deputy electrical engineer by the Wigan Corporation, in succession to Mr. J. M. Beck, who has resigned on account of ill-health. Mr. Winstanley will, for the present, continue his duties as station superintendent in addition.

Mr. F. C. Clarke, Principal of Rotherham College of Technology and Art, is the new chairman of the Sheffield Sub-centre of the Institution of Electrical Engineers.

Mr. S. E. Britton, M.I.E.E., M.I.Mech.E., engineer and manager of the Chester City Electricity Department, an account of the recent rural development work of which appears on page 77, has been responsible for many innovations during his thirty-six years' service with the undertaking. Shortly after taking up his appointment at Chester in 1905 he undertook the conversion of all the gas street lamps to electricity. The construction of a hydro-electric generating station on the River Dee occupied a good deal of his attention between 1912 and 1913, and between 1917 and 1919 he investigated the hydro-electric possibilities of the river from Chester to Llangollen on behalf of the Board of Agriculture and Fisheries.

Mr. S. E. Britton

In 1920 he prepared the scheme for setting up a Joint Electricity Authority for North Wales and Chester. The next year he initiated a plan for extending the area of supply into sixty-two square miles of rural area around the city and in 1922 purchased for the Corporation the generating station at the Queensferry munition works, erecting one of the first 33-kV overhead lines in the country, from the power station to Chester. A further scheme for adding another seventy-seven square miles to the rural supply area was commenced in 1927. Between 1930 and 1934 the change-over from DC to AC was effected, a connection with the grid scheme being made in 1932. Just before the outbreak of the war a proposal for the extension of the Queensferry power station at a cost of £400,000 was rejected.

Before taking up his post at Chester Mr. Britton served for three years as borough electrical engineer and manager at Motherwell, and held a similar position for twelve months at Barking. Prior to that he was assistant electrical engineer at Southampton. He served his apprenticeship with Crompton & Co. at Chelmsford. In 1934 he was elected president of the I.M.E.A., and served twelve years on the Council. He was chairman of the I.E.E. Mersey and North Wales (Liverpool) Centre in 1928 and chairman of the E.D.A. North-West Area Committee in 1932. Mr. Britton was a member of the Electricity Commissioners' Conference on Electricity Supply in Rural Areas in 1928 and gave evidence before the McGowan Committee on Electricity Distribution in 1936. He has also read several important papers from time to time including one on "Rural Electrification in Great Britain" at the Third World Power Conference at Washington.

Mr. J. P. Thomas, M.I.E.E., M.Inst.T., who until June, 1938, was general manager (railways) of the London Passenger Transport Board, has been appointed to assist the Board in dealing with problems of the use of tube railways as air-raid shelters.

Royal Society Awards.—The King has approved the recommendation of the Council of the Royal Society for the award of Royal Medals to Dr. F. H. A. Marshall and Professor P. M. S. Blackett. Professor Blackett's award is in recognition of his studies of cosmic rays and the showers of particles which they produce, for his share in the discovery of the positive electron, for his work on mesons, and many other experimental achievements. The Royal Society has also made the following awards:—The Copley Medal to Professor P. Langevin, Foreign Member, for his pioneer work in the electron theory of magnetism, his fundamental contribution to discharge of electricity in gases and his important work in many branches of theoretical physics; the Rumford Medal to Professor K. M. G. Siegbahn for his pioneer work in high-precision spectroscopy and its applications; and the Hughes Medal to Professor A. H. Compton for his discovery of the "Compton effect" and for his work on cosmic rays.

At the annual meeting of the Junior Institution of Engineers on November 16th, **Mr. J. W. Stenson** was elected chairman for the ensuing year and **Messrs. N. C. Ablett,** B.Sc., Wh. Ex., and **L. P. Walter** were elected vice-chairmen. The inaugural meeting of the Institution of the 1940-41 session will be held on December 14th when the president, **Sir Charles H. Bressey,** C.B., C.B.E., D.Sc. (Eng.), will present the medals and other awards won by members (resident in London) during the past session. Sir Charles will then inaugurate as his successor **Viscount Falmouth,** who will give an address, after which an informal reception will be held.

In reviewing the annual report of the Barnstaple undertaking last week we regret that we inadvertently gave the name of the late borough electrical engineer, Mr. J. W. D. Cooke. **Mr. R. Robinson** was appointed to the post on Mr. Cooke's death nearly two years ago.

Obituary

Mrs. N. McLean.—We regret to hear from Mr. N. McLean, who retired from the position of borough electrical engineer of Harrogate about a year ago, that Mrs. McLean died suddenly on November 11th, at Andover, where they have lived since Mr. McLean's retirement.

Mr. L. J. Norton-Taylor.—In his 1939-40 report Mr. M. Cable, the general manager of the Wellington (N.Z.) Tramways and Electricity Departments, pays a tribute to Mr. L. J. Norton-Taylor, chief accountant of the Departments, who died in May last. Mr. Norton-Taylor joined the Tramways Department in 1904 and was appointed chief accountant in 1936.

Making Rural Supply Pay *(Concluded from preceding page)*

An excellent example of how one motor can be utilised to do several services such as grinding, cake breaking, etc., is to be seen at Mr. A. W. Darlington's Tarvin Pool Farm, while Mr. Forbes' poultry farm at Clutton is so highly electrified that the annual consumption is about 64,000 kWh. An interesting and profitable experiment was carried out this summer by Mr. Dudley Beck, whose all electric restaurant, "Quaintways," has an installed load of approximately 500 kW, comprising cooker, baking, stillroom service equipment, water heating, air conditioning, etc. On the roof of the restaurant he had a greenhouse erected and equipped with tubular heaters. At a cost of 30s. 2d. for electricity during the period from March to June 10th he was able to produce 620 lb. of tomatoes worth on an average 1s. 0¾d. per lb. from 67 plants. Though nothing to do with farming it is of interest to hear that Mr. Beck is able to show a profit of £2 a week on the restaurant's laundry at a cost of 9s. 2d. for electricity. One further indication of the attention which the Department pays to developing new ideas is apparent from recent experiments with the use of drying cabinets for preserving vegetables such as peas, butter beans, apple rings, beetroots, horseradish, french beans and turnips.

We could go on almost indefinitely giving further examples of the undertaking's enterprise and of the way in which it is helping the farmer, especially in these difficult days. Indeed, as Mr. Britton pointed out in a paper read at the 1936 World Power Conference in Washington, the rural development scheme has to a large extent revolutionised the habits and methods of those it serves, and has changed the daily routine of many engaged in rural industries, businesses and agriculture by making possible reorganisation, development and increased employment.

In conclusion we should like to thank Mr. Britton, as well as his staff, in particular Mr. C. A. Britton, the deputy engineer, and Mr. T. Smith, mains engineer, rural area, for their assistance in the preparation of this article.

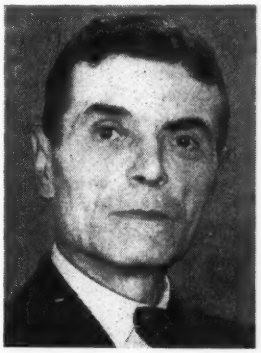
RULES FOR ELECTRICAL MINING—I

A Review of Regulations during the last Thirty-five Years

By J. A. B. Horsley, O.B.E., M.I.E.E.

THE bearing of the recommendations made by the Royal Commission on Safety in Coal Mines (presented to Parliament in December, 1938), for the amendment of the existing general regulations governing the installation and use of electricity in mines to which the Coal Mines Act, 1911, applies, cannot be appreciated fully without some knowledge of existing electrical regulations and those which preceded them.

The first code, made under the Coal Mines Regulation Act, 1887, and issued in 1905, was the outcome of the deliberations of a Departmental Committee appointed in 1902 by the Home Office. James Swinburne was an original member of that Committee, his place being taken subsequently by the late W. H. Patchell, and the late Silvanus Thompson "gave practical demonstrations (to the Committee) with the aid of working models, of the application of three-phase currents to machinery." The following quotation from the Committee's report will indicate its attitude towards the risks involved: "When, therefore, we reflect upon the mitigation of severe and exhausing labour, and the far greater efficiency that the use of electricity is likely to produce, and which ought to result in benefit to the miner, the consumer, and the coal owner alike, we have no hesitation in saying that this new agent ought to be welcomed."



Mr. J. A. B. Horsley

The code of 1905 was issued as "Special Rules"; that is to say, to give them legal effect it was necessary that they should be established at each mine, in statutory form. They applied both above and below ground; both in their attention to detail and in their phraseology they bear evidence of collateral origin with the wiring rules which exercised the ingenuity of electrical engineers of that day.

Perhaps to temper the wind to the shorn lamb, or possibly because there was then but a slight foundation of experience upon which to build, that code was prefaced by the placative sentence that . . . "the following rules shall be observed, so far as is reasonably practicable, in the mine." Indeed that phrase, or its equivalent, recurs 14 times in the 56 rules comprising the code.

Extracts from 1905 Code

Those rules required that the metallic enclosure or armouring of cables, excepting trailing cables (i.e., flexible cables used with coal-cutting machines) and the frames of generators, transformers and motors, excepting portable motors (i.e., coal cutting machines) should be earthed, if the circuit exceeded 250 V. Metallic enclosure of conductors, even at 650 V, was not obligatory and the use of spaced, single-conductor unarmoured cables was acceptable as an alternative.

Open switches and fuses were permitted, provided they were housed "in machine rooms or in compartments specially arranged for the purpose," but it was required that "main and distribution switch and fuse boards should be made of incombustible insulating material, such as marble or slate," provided that it was free from metallic veins. Some of us will have memories of that stock phrase, anent metallic veins, without which no switchboard specification was complete!

It is not surprising that one of the 1905 rules demanded that "the insulation of every complete circuit other than telephone or signal wires used for the supply of energy, including all machinery, apparatus, and devices forming part of or in connection with such circuit, shall be so maintained that the leakage current shall so far as is reasonably practicable, not exceed 1/1,000 of the maximum supply current, and suitable means shall be provided for the immediate localisation of leakage." In passing, it may be pointed out that in a 500-V, 100-A circuit this standard is equivalent to an insulation resistance of 5,000 ohms.

Trailing cables were required to be protected "with either galvanised steel wire armouring, extra stout braiding, hose pipe, or other effective covering." At points where the circuit was intended to be broken "the use of hooks or other makeshifts" was forbidden and "proper switches" were required. If sparking or arcing occurred outside a coal-cutting machine, or on the cable, or the rails, the machine was to be stopped until the defect had been repaired.

Both trolley and storage battery locomotives were provided for; regarding the latter, if used where firedamp was a hazard, it was required that the battery box as well as the motor should have a flame-tight enclosure. Alas, a wholly satisfactory solution of that problem, the flameproof enclosure of a battery box, is yet to seek. Arc lamps were permissible, if there was no danger from the presence of coal dust; where firedamp might occur electric lamps, if used, were to be of the vacuum or enclosed type, enclosed in gas-tight fittings of strong glass and having no flexible cord connections.

The code permitted shot firing by electricity from the lighting or power cables, in sinking shafts and stone drifts, a concession that was subsequently withdrawn. The method, however, has recently been revised experimentally for simultaneous shot firing, with due precautions, in pit sinking. Throughout the code there are references to special precautions that were to be taken in places where firedamp might be encountered. Indeed, there were eleven clauses touching the construction or the use of electrical apparatus or cables where that hazard was contemplated. Passing reference has already been made to two of these clauses.

Switches, fuses and cut-outs, this last term implying, it would seem, an automatic circuit breaker in modern parlance, were required to be "enclosed in gas-tight boxes or (to) break under oil." Belief in the "gas-tight box" is not quite extinct even now and it was not until some twenty years later that oil-immersion ceased to be accepted as a satisfactory substitute for flameproof enclosure. Motors with their starters, terminals and connections were, by another rule, required to be "completely enclosed in flame-tight enclosures, made of uninflammable material, and of sufficient strength as not to be liable to be damaged should an explosion of firedamp occur in the interior." Here, then, we have the equivalent of flameproof enclosure, as it is understood to-day.

Signalling circuits with bare line wires were likewise forbidden in such places, except in haulage roads, and a limit of 15 V was imposed. If these restrictions on signalling were then believed to make such circuits safe, a rude awakening awaited the mining industry, for it was shown experimentally in 1913, following the severe explosion at Senghenyyd Colliery, that sparking produced by the ringing of an ordinary mine signalling bell when energised by two dry cells (at 3 V) could ignite firedamp readily.

It was required by the code of 1905 that "a competent person shall be on duty at the mine when the electrical apparatus or machinery is in use; and at such time as the amount of electricity delivered down the mine exceeds 200 BHP a competent person shall be on duty at the mine above-ground, and another below-ground." This incipient recognition of the place of the electrical engineer in mining has more than historical interest, for in 1909 the Association of Mining Electrical Engineers was founded, a technical body, but having as one of its objects the raising of the status of those engaged in the application of electricity to mining. To conclude these excerpts from that earlier code, there was a general exemption for existing plant, subject to a power of objection by the mines inspector, but with a right of appeal reserved to the owner.

Revision of Rules

In 1909 the Home Office again appointed a Departmental Committee, consisting of Sir Richard Redmayne, the Chief Inspector of Mines, the late Dr. Charles Merz, whose name needs no exordium, and Mr. Robert Nelson, then recently appointed Electrical Inspector of Mines, to revise the special rules of 1905. In the result, the draft prepared by that Committee was included in Part III of the General Regulations of 1913, which were made under the Coal Mines Act, 1911.

By a preamble it was provided that those electrical regulations

" shall not apply in the case of any apparatus used above-ground, except such as may directly affect the safety of persons below ground." The surface installations at mines then came under the factory electrical regulations of 1908, which were made under the Factory and Workshops Acts, 1901 and 1907, in so far as the premises came within the definition of a factory, or workshop in those Acts. In 1920, however, the underground code of 1913 was applied, with certain modifications, to surface electrical installations at all mines under the Coal Mines Act, thus superseding the factory code and assimilating practice above and below ground.

The general regulations of 1913 took as their starting point a power of objection to the introduction of electricity, or to the continuance in use of electricity, that Section 60 of the Coal Mines Act, 1911, conferred upon the inspectors of mines, subject to a right of appeal to arbitration. The inspectors could object, to quote the terms of Section 60, " where on account of the risk of explosion of gas or coal dust, the use of electricity would be dangerous to life."

Large Measure of Discretion

The ground of objection while admirable in principle was, it may be admitted, lacking in precision and the Royal Commission, while preserving the general power of objection vested in the inspector in special cases, has proposed a definite criterion founded upon the standard of ventilation normally attained. The code of 1913, while it jettisoned much of the detail included in that of 1905, including the prescription of a standard of insulation resistance based upon the maximum current in the circuit, and reflected the advance in technique that had marked the interval, did not depart in principle from the earlier code.

This principle, common to both codes, consists in leaving to the persons affected a large measure of discretion in construing the rules, in practice. The code of 1913 did, however, insist that the metal coverings or framework of all apparatus and the armouring of all cables should be earthed effectively and by connection to an earth plate at the surface of the mine, excepting only fixed apparatus where the circuit did not exceed 125V AC or 250V DC.

The new code also required that cables, excepting flexible cables, should be armoured, if the circuit exceeded 250 V, or if the roadway in which the cable was laid was used for mechanical haulage, or if there was a risk of igniting gas, coal dust, or other inflammable material, with a concession permitting the use of single-conductor unarmoured cables in gate roads to supply portable apparatus on DC circuits at 650 V. This concession, however, was also governed by the conditions that there should be no mechanical haulage in the gate road and no risk of igniting gas, coal dust, or other inflammable material. In the result, armoured roadway cables were required, or were voluntarily used everywhere, except for roadway lighting circuits at low voltage and even for that armoured cable is now universal.

Armouring and Earthing

Following street practice, cables armoured with steel tapes had found their way into some mines, but the 1913 code, by prescribing that the electrical conductance of the armouring should be no less than 50 per cent. of that of the live conductors in the cable, virtually insisted upon the use of wire armouring. By way of compensation it was provided expressly that the armouring might be used as the earthing conductor for the apparatus supplied by the cable. The regulation touching flexible cables did not err in the direction of curbing the ingenuity of inventors, but it did reject reliance upon the flexible metallic covering, if any, of the cable as the only earthing conductor for the portable apparatus supplied by the flexible cable.

The 1913 code may be said to have introduced the idea of referring to British standard specifications in legislation by requiring that " the lead sheath of lead-sheathed cables and the iron or steel armouring of armoured cables shall be of not less thickness respectively than is recommended by the Engineering Standards Committee." This was surely a modest beginning, but the principle has been accepted by the Royal Commission in relation to certain other mining appliances and with respect to electrical apparatus in general.

The 1913 code recognised the importance, as affecting the safety of the mine, of the colliery electrician, although no attempt was then made to prescribe any standard whereby his competence was to be assessed. Indeed, the Committee rejected the suggestion put to it in evidence " that certificates of competency should be issued, after examination by the Home Office, to persons in charge of electrical plant in mines." It did so on the ground that " considerations of habit and character are of even greater importance in this connection than technical knowledge." The Royal Commission has made specific proposals to this end.

The 1913 code gave currency to a new phrase, " open sparking," meaning " sparking which owing to the lack of adequate provisions for preventing the ignition of inflammable gas external to apparatus would ignite such inflammable gas." This definition did not lack breadth, if the operative regulation in which the new term was used, did not escape difficulty of interpretation of the terms of its opening clause, which read . . . " In any part of a mine in which inflammable gas, although not normally present, is likely to occur in quantity sufficient to be indicative of danger, the following additional requirements shall be observed."

The primary requirement, in brief, was construction such that in normal working there should be no risk of open sparking. This applied to signalling circuits as well as to cables and apparatus used for power or lighting. Motors, in articular, were required to be " constructed so that when any part is live all rubbing contacts (such as commutators and slip rings) are so arranged or enclosed as to prevent open sparking." This, by implication at any rate, admitted unenclosed squirrel cage motors, but with the efflux of time practice was directed to complete flameproof enclosure, even for motors without " rubbing contacts."

The Committee rejected a suggestion made in evidence " that the Home Office should officially approve certain types or designs of electrical apparatus for use underground." Three reasons were (i) " that official approval would hamper progress " ; (ii) that " approval of each individual piece of apparatus would be involved for the system to work effectively " ; and (iii) that " such approval might engender less consideration on the part of the management of a mine in introducing electricity, and less care in maintenance and operation afterwards."

It is true there were difficulties to be overcome, but in the interval official certification of the flameproof enclosure of electrical apparatus has been established, on a voluntary basis, and official approval of signalling bells and telephones has become obligatory where safety lamps are required to be used.

Battery Locomotives

In the code of 1913 trolley locomotives were forbidden in any mine in which coal is worked, but storage battery locomotives were permitted subject to official consent in each instance. A brief reference, at this point, may be permitted to the offer in 1922 by the late Charles Markham, a colliery proprietor, of a prize of £1,000 to be competed for by designers of " a safe and efficient electrical storage battery locomotive for use underground in coal mines, with a view to the ultimate supersession of the pit pony in deep and hot mines."

The competition was duly held in 1925, there being five entrants, and the prize was awarded to Joseph Booth & Bros., Ltd., of Leeds, but although from time to time battery locomotives have been used in British coal mines it cannot be claimed that this mode of transport for mineral, or for men, has proved to be a serious competitor to rope haulage.

Quite recently, Diesel-engine-driven locomotives have attracted the notice of mining engineers in Britain and official approval has been given in suitable instances to enable practical trials to be made by which alone can the economic advantage of this type of locomotion be established. The enclosure of the engine with the exhaust conditioner has been designed to comply with flameproof principles as applied to electrical apparatus, while emission of flame from the inlet and exhaust ports is guarded against by a device, consisting of a number of closely spaced plates, that was originally developed for electrical machinery, and is still used on the Continent to provide for relief of pressure and to permit the circulation of a stream of cooling air in electrical apparatus.

As in the case of the earlier code, general exemption was provided for existing cables and apparatus, but with a time limit of six years to the end of 1919. Provision was also made for conditional exemption from particular regulations, on the ground of emergency or special circumstances, and there have been numerous instances of such exemptions having been granted ; for example, to permit the continued use of cables with steel tape armouring which lacked the requisite conductance of 50 per cent. of that of the live conductors, and to allow the use of small flexible cables for shot-hole drilling machines, comprising an earthing conductor of smaller cross-sectional area

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INSTITUTION PROCEEDINGS

Solar Energy. Electric Farming. Colliery Equipment

Power and Combustion

THE twenty-seventh Thomas Hawksley Memorial Lecture, which bore the above title, was delivered at the INSTITUTION OF MECHANICAL ENGINEERS in London recently by Prof. A. C. G. Egerton, professor of Chemical Technology at the Imperial College of Science, South Kensington, and secretary of the Royal Society. The object was to examine sources of power in an attempt to assess their scales and the extent to which use could be made of fire. The professor commenced by explaining how the earth received a practically constant supply of energy radiated from the sun, amounting to about 1.35 million ergs per second falling on any sq. cm. of surface facing the sun outside the earth's atmosphere. Only about a two-thousand-millionth part of the radiant energy emitted by the sun reached the earth. About 35 per cent. of the energy was used in evaporation, one-three-thousandth of the earth's waters being lifted every year, so that 320 million HP might be obtainable from the potential water-power resources of the various countries of the world.

The fickleness of the wind and its unsuitability for large power development militated against its wider use. Tidal power was mainly derived from gravitational effects of the moon's mass. The total power corresponding to the dissipation of energy of the tides was considerable (10^9 kW) but mainly dissipated in about fifty favoured regions, very few of which could be used at all conveniently.

Natural Steam

In some volcanic districts natural steam from fumaroles was utilised for generating power. The use of atomic energy was not yet practicable. Attempts to employ the difference of temperature between the lower and upper layers of tropical seas would involve bulky plant and much capital expenditure. The energy in a single flash of lightning was of the order of 4,000 kWh; throughout the world the number of flashes per second was about sixteen, but no serious attempt had been made to capture this natural source of high-voltage electricity.

Photosynthesis and the assimilation of radiant solar energy by plant life led the professor to the vegetable origin of coal and oil, the present rate of use of which corresponded to a power of 2×10^9, converted from total calories used per annum. Estimated potential hydro-electric power was 3.2×10^8. The world production of electric power (1937) was 3.10^7 HP. The world's available electric power, if all the coal and oil won were used for its generation was estimated as 2.2×10^9 HP. Comparing the two main sources showed that hydro-electric power accounted for 30 million HP (1.7×10^{17} calories per year) and coal and oil together for 1.3×10^{19} calories per year, or that hydro-electric power amounted to only 1.25 per cent. of the world's utilisation of energy.

Coal and oil could be transported, whereas electricity was at present limited in its range of distribution from the source. A lead-acid accumulator weighed from 30 to 50 kg. per kWh and the nickel-iron-alkaloid type 40 kg. per kWh. Theoretically, without taking into account the deadweight of the means of supporting the active materials, or the container, or the electrolyte, the weight per kWh of the lead and sulphate ions alone would still be about one-fifth the above quantity. Even if a hydrogen-chlorine cell were a possibility the weight of ions transported would still be above one kg. per kWh. This did not compare with the 0.25 kg. per kWh obtainable at 30 per cent. efficiency by the combustion of petrol in an engine. Electrical energy conveyed in a copper wire at the safe current rate involved only 2×10^{-2} kg. per kWh.

Control of Power

Professor Egerton maintained that a little less than 1 HP was in use continuously per insured person in Great Britain, averaged throughout the year; which meant that behind each worker there stalked about ten assistants of equal power who supplemented his work, but over whom he exercised little control. They could only be adequately directed by central authority acting under common consent.

The amount of total mechanical and electrical power produced and utilised throughout the world was of the order of 10^8 HP. In 1937 power stations in Great Britain consumed 11 million tons of coal; if their efficiency had remained as it was in 1910 some 29 million tons would have been consumed. The gross effect of combustion reactions was known; but how those reactions took place was still not known. That question had caused much activity in chemical research in recent years, a proper understanding of ignition (of hydrocarbons) being essential to the accurate appreciation of the processes which controlled flame travel; caused the "knocking" propensity of the liquid fuel to be the limiting factor in the design of petrol engines, and indicated how petroleum should be treated to improve the quality of fuels derived from it.

This lecture on the derivation in several ways of power from the sun led Prof. Egerton to the conclusion that for the whole world the total mechanical work performed by the manual worker and his horses and oxen was not much less than the total amount of power generated from the burning of fuel and from water power. This work was done at the expense of energy of foodstuffs got by agriculture, through photosynthesis. The human being ate on the average quite twenty times the energy in the form of food that he expended in work. The lecturer suggested that economists might consider international price control of the key food (wheat) and of the primary fuels too, to balance production against consumption, so making world material economy more smooth than it had been in the past and permit freedom and competition in all other activities.

It seemed that present economy differentiated insufficiently between the using-up of real irreplaceable capital and the replaceable products of continual solar radiation. He sketched in some perspective the fundamental facts and figures upon which our material existence depended in order to incite others to delve deeper in an effort more accurately to assess the basis of our material economy, for there was need to look to the future.

Rules for Electrical Mining

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than the minimum size prescribed for general application 0.22 sq. in.)

This cursory sketch of the regulations of 1913 may be rounded off appropriately with the following quotation from the report of the Committee that prepared them, namely, that "the feeling against the use of electricity in mines which found expression in some parts of the country was largely based, the Committee considers, either upon a vague fear due to lack of knowledge, or upon experience of the behaviour of badly constructed or badly maintained apparatus. The Committee knows of no place below ground in which electricity is in use to-day where both kinds of accident (i.e. (*a*) ignition of gas, coal dust or other inflammable material due to open sparking and (*b*) electric shock) would not be avoided if the best present-day practice as regards construction and maintenance were complied with."

While this expression of the Committee's opinion may have been literally true, as touching construction and maintenance, it lacked nothing in optimism. The designer, certainly, has not been content to stop at the standard of those days, in the endeavour to control the hazards of shock, fire and explosion, whereby the use of electricity in the 25 years following the enactment of the new code has increased between three- and four-fold without a corresponding rise in the number of accidents attributable to the use of electricity.

Mining Electrical Equipment

CHANGES in the design of control devices in relation to mining requirements, growing capacity of generating systems, interconnection of networks and experience gained at short-circuit testing stations are discussed in the address prepared (for publication) by Mr. N. V. Castling as president of the London branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS.

Mr Castling says that the outward appearance of metal-clad switchgear has not changed very much, but for some voltages a radical change has taken place because of the adoption of small-oil-volume and air-blast principles. It is not yet established that advantage of the latter in design and performance will justify its adoption. For voltages below 33 kV the present standard designs will hold their own for some time to come.

Dealing with circuit-breakers and associated equipment suitable for use in mines and similar places, Mr. Castling illustrates some recent innovations in design without the use of oil, and having isolating features in accordance with the requirements of the Mines Department. In his opinion the tendency is to use air-insulated control gear for medium-voltage systems inbye, owing to ease of maintenance, and the isolators and other protective fittings are more conveniently added.

Interlocking Arrangements

In mining switchgear, malleable iron or gunmetal dividing boxes are being favoured instead of cast-iron, particularly for boxes that can also be used as straight-through junction boxes, the object being to prevent accidents due to fracture of the enclosure. Ease in making and breaking cable box joints is a most important consideration to the user, and standard cable-boxes should be suitable for fixing at several angles. For the protection of mining apparatus the series overcurrent coil is still widely used, and to obtain the best operating conditions a suitable time-lag device should be fitted.

Plug interlock has usually been provided by a mechanical attachment to the circuit-breaker. That does not prevent the removal of the plug at the feeder end, and it is becoming more common to provide an electrical interlock at both ends, which necessitates a 5-core instead of a 4-core cable. For the remote control of conveyors and coal-cutters the pilot circuit needs special consideration, should be intrinsically safe and arranged to open the main circuit in the event of a short-circuit of the pilot wires in any place other than the pilot switch.

New regulations are being prepared as a result of the report of the Royal Commission on Safety in Mines, and there is little doubt that some of them will be much more severe than those at present in force.

Modern 33-kV metal-clad sub-stations include oil-immersed isolators in a totally enclosed metal-clad structure, with consequent considerable reduction in overall dimensions as compared with the open type, in addition to several novel operational and construction features. The panels can be erected in a single row, or in two parallel rows, according to the site facilities available; in either arrangement the busbar ring is completed by means of cable connections. The six-position busbar selector enables each individual circuit to be fed from the busbar sections on both sides, or from either side, and also permits complete isolation of the circuit from the busbars for maintenance without interrupting the busbar ring or interfering with the service of adjacent panels.

Remote Control

The circuit-breaker is arranged for remote electrical control and is of the non-draw-out pattern; its position, however, enables its tank to be lowered, and the fully-interlocked earthing and isolating switches allow maintenance operations to be performed in complete safety. All earthing and isolating switches are direct manually operated at the mimic diagram panel on the operating gallery, with full visual indication of the operation in progress, and the complete interlocking system ensures mistake-proof operation.

Development has been proceeding on the lines of reducing the oil content of circuit-breakers for 33 kV and above. Several types now on the market comprise three single-break single-phase units mounted on a steel framework and arranged for pneumatic operation. In the simplest form, no provision is made for current transformers within the circuit-breaker construction, but in other forms it is possible to accommodate either straight-through or "stabec" insulated cascade type current transformers. Separate current transformers are preferable, because they allow any necessary modification to be made in the shortest possible time. Auxiliary switches are provided, as required, for indication, interlocking or any other purpose.

Air-blast circuit-breakers do not yet possess the same standard of safety as the small-oil-volume type. Their operating parts are more numerous and complicated, and owing to the constant air supply the circuit at light duty is broken at a forced zero, causing voltage rises and unnecessary stress on other parts of the network, particularly with overhead lines. The use of air as the insulating medium renders the overall dimensions much larger than those of the small-oil-volume type, and they cannot readily be adapted to metal-clad switchgear.

Electricity on the Land

THE first of the written contributions (invited for publication in the *Journal* of the INSTITUTION OF ELECTRICAL ENGINEERS) to the discussion of the critical study of the applications of electricity to agriculture and horticulture, undertaken by Mr. C. A. Cameron Brown for the Electrical Research Association (which was referred to on November 15th, page 33) has been submitted by Mr. H. W. Grimmitt (Electricity Commissioners' staff). This introduction reveals that the co-ordinating steps taken by the E.R.A. have been recognised by the Ministry of Agriculture and the Agricultural Research Council; and that certain suggestions made in report W/T2 have been anticipated to the extent of initiating research into the load factor of grinding on farms, ultra-violet irradiation of poultry, heating of poultry-rearing plant, soil heating and sterilising, and the heating of grain-sprouting cabinets.

To the producer of milk and its by-products electricity has more to offer than to any other kind of farmer. Appreciable loads and annual revenue are obtainable and labour can undoubtedly be saved. While a little more milk is obtainable by hand, machines make the work more agreeable. In America machines are definitely favoured, from the labour-saving aspect, official figures showing an average increase of 112.7 per cent. in output of milk per hour of labour, and, in all, a saving of labour of 52.1 per cent. Mr. Grimmitt has good reason to believe that many farmers are evading their full obligation with respect to milk cooling, which is an electrically attractive operation, the connected load being from 0.5 to 1 HP and the return between 500 and 1,000 kWh per consumer per year for a 30-cow herd.

Mr. H. W. Grimmitt

The supply of water is a primary essential, but the tendency is still towards the simple substitution of a motor for the previous source of power in ignorance of what can be done by automatic electrical operation under air pressure control, which has all the advantages of water-mains supply but at a substantially lower cost. Hot water and steam for washing and sterilising dairy utensils represent one of the biggest agricultural loads waiting to be fully developed; on an average farm these operations could account for between 5,000 and 10,000 kWh per year. An American departure from the usual types is a storage outfit of small loading that operates for long periods under thermostatic control, which has great possibilities in areas where the higher loading of electrode boilers and self-contained steam-raising chests are not welcomed.

On the poultry farm too, electricity can play a substantial part. Some means of heat storage for hovers and brooders and incubators would create more confidence; above all, a prevalent idea that needs dispelling is that electricity is generally a medium for "soft" rearing and not suited to chicks required for first-class stock.

Modification of Methods

The main feature of general farmyard and barn power loads is their very poor load factor, rendering justification difficult. A 15-HP motor may be used for not more than two hours a week, the result of which is felt more directly on isolated single-phase systems. Modification of traditional methods, say of grinding and threshing, would enable simpler and cheaper machines to do a corresponding amount of work over a longer period with power reduced by 50 per cent. They might be made to run automatically all day, or at night, needing the employment of fewer men.

For horticulture current tariffs are such that the relation of cost to convenience and technical merit has to be weighed very

carefully. So far it has not been possible to justify large-scale glasshouse heating electrically, though there are ways in which electricity can with advantage assist. For the heating and sterilising of soil all that is required is authoritative codification to avoid obscuration of possibilities. Similarly, in the case of many other applications there is a mass of miscellaneous experimental information that needs to be properly sorted out.

Two of the most controversial applications are, first, electroculture (static discharge to and on growing crops) which Mr. Grimmitt states guardedly " in the light of present knowledge " appears to have been disposed of as an unpractical proposition. Secondly, there is electric ploughing which kind of power application is one of the least suited to electrical operation because of the difficulties associated with trailing flexible cables. But, were some new circumstances to arise, such as a shortage of oil fuel, electric ploughing machines could very soon be made to do the heavy field work. They could be either of the Continental cable-winding type or, probably better for British conditions, tractors with flexible cable feeds like those developed to such a pitch in New Zealand by Mr. H. G. Kemp, who now had fifteen doing regular work.

The cost of providing service and of wiring farms and plant is the reason why most farms in this country are not using electricity as they might do.

Earthing Considerations

EARTHING was the subject on which Mr. H. W. Grimmitt (Electricity Commissioners' staff) had intended to lecture at the (cancelled) November meeting in London of the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS. His intention was to point out definitely that in areas of high resistivity it is not possible to obtain a low earth resistance, no matter what design or treatment is resorted to, at an economical or reasonable cost. It was perhaps due to the Post Office that the general practice in Great Britain is to earth systems, so that they shall in no way interfere with telecommunications. There are, however, in this country some unearthed high- and low-voltage systems and all appear to work satisfactorily.

Simple forms of earth testers which can be used as readily as insulation testers have enabled engineers to realise in some measure the limitation of the methods of earthing which have been used for many years. There are on the one hand " system earths " and on the other the " equipment earths " of non-conducting metal-work. It is always best to keep this subdivision in mind and technically to keep these earths separate. When dealing with a small substation in a rural area where the whole system is overhead, the position of the earth electrode is important, and the neutral at or near the substation should be earthed through not more than 4 ohms. There is no need at all for the earth to be strictly under the transformer, or in close proximity to the substation.

From the specific resistance of the earth in the vicinity it is possible to design an electrode which will give the required earth resistance. The measurement of the resistivity may easily vary from 500 to 500,000 ohms per cu. cm. Therefore an ordinary 6-ft. pipe driven into soil of 20,000 ohms per cu. cm. is of no use for the earthing of a small substation neutral, or metal-work of a cooker. It should be remembered that the regulations for earthing electrical installations to metal water pipes and water mains, published by the Institution of Civil Engineers, only permit " equipment earths " to be connected to the water mains.

The resistance of an electrode is largely due to the resistance of the first 10 ft. of soil surrounding it. The chief disadvantages of a plate are that a very large amount of excavation is required, and the connection is buried. A good resistance can undoubtedly be obtained more cheaply by means of a rod or a strip.

The Central Electricity Board has found that the normal foundations of its towers are of lower resistance than a 6-in. diameter cast-iron pipe 6 ft. long buried in coke, so in some areas it has consequently dispensed with earth electrodes. Concrete foundations, and the concrete bed of a motor, may in some circumstances provide a good earth.

One of the main sources of accidents to animals due to earthing are voltage gradients round earth electrodes. If it is not possible to place the electrode in such a position that animals cannot walk over it, a rod electrode is best with the first 2 ft. 6 in. of it insulated by placing an earthenware pipe over it and filling the intervening space with bitumen. A simple protective means is a light fence round the buried electrode.

(Continued at foot of next column)

The earthing of a low-voltage neutral in a rural area is perhaps the most difficult problem. It is definitely advisable to have a resistance of 4 ohms or less and in some places this entails burying a strip electrode of a fairly long length. In soil of 10,000 ohms per cu. cm. one requires a strip approximately 200 ft. long.

Neutralising by earthing the neutral at one point (the substation), insulating it throughout its length and connecting all extraneous consumers' metal-work to the neutral is by no means new. All apparatus on the far side of any breakage may be raised under certain circumstances to practically the full phase potential. This risk can be greatly minimised by balancing the load on the three phases as demonstrated by tests on village systems.

Protective multiple earthing is an improvement on this, but it should be remembered that some other countries have 100 V systems, and some provide for little else than a lighting load.

The Electrical Research Association, in its second report on the safety of consumers, has gone into this question very fully and Mr. H. G. Taylor will be giving the Association a lecture on the subject later in the session. Earth leakage switches, in Mr. Grimmitt's opinion, need not be considered in urban areas or where an earth is such that the fuse installed will operate.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions.

IN the Editorial of your issue of November 8th, there was a paragraph referring to some comments written by Mr. J. W. Koehler in the *Electrical News & Engineering*, of Toronto, on the subject of the possible reduction in output of electrical energy caused by a wide-spread use of small fluorescent lamps.

I am particularly interested in Mr. Koehler's remarks, as a great many years ago, in 1909 to be correct, I read a paper at Liverpool during the I.M.E.A. Convention (which was held at Manchester), and in this paper I referred to the fears which had been expressed as to the effect on the output of electricity supply undertakings by the substitution of metal filament lamps for the then more generally used carbon filament lamps. I ventured then to express certain views as to what would be the result of the introduction of a much more efficient light giver, and I am very glad to say that these views were afterwards borne out in actual practice ; so it will be again, I feel absolutely certain, that there is less to fear in 1940 than there was in 1909. Among the many reasons for this are the following :—

At the present time the lamps are not suitable for universal adoption, and, secondly, that as at present available, there are very many positions where users—ladies especially—will prefer a somewhat warmer light than that given by the so-called " daylight " fluorescent lamps, which, although exceedingly near to daylight are very cold and hardly suitable for use at social gatherings when artificial light is required and ladies are present ; further, the price of these lamps at present is quite sufficient to slow down their use for replacement of ordinary tungsten filament lamps.

Should in any particular undertaking an adverse financial result be brought about due to the use of the lamps, it should be quite easy to so adjust the unit price as to put matters straight again.

Finally, it is my firm belief that anything that tends to add to the efficiency of use in any service for which electrical energy can be used is all to the advantage of electricity supply as an industry.

Maidstone, *November 19th.* E. E. HOADLEY,
Engineer and Manager.

Factory Lighting

In your issue of November 8th, Mr. J. B. Harris criticises the figures which I have used for light output of tungsten filament lamps in my recent article. These were taken from the second (revised) edition of " Modern Factory Lighting " dated July, 1940, which admirable volume is issued by the British Electrical Development Association in conjunction with the E.L.M.A. Lighting Service Bureau whose publications put forward up-to-date manufacturing practice as distinct from the academic view.

As regards voltage I stated that the table was representative only. " LIGHTER."

November 17th.

CIRCULATING-WATER SCREENS

Details of Modern Practice

By T. H. Carr, A.M.I.Mech.E., A.M.I.E.E., M.A.Min.E.E.

THE circulating water screens used in connection with power stations are generally one of three types, viz.:—Fixed, travelling or revolving. The first is used as a primary screen to protect the more expensive mechanical type or where only coarse screening is required. The inlet works of almost every station, whether of small or large capacity, will usually require some form of coarse screen to prevent the ingress of large floating debris to the screening chamber. It is desirable that the velocity of the water flowing through the coarse screens should be kept within reasonable limits, say, from 1 to 4 ft. per sec., in large and small stations respectively, as large submerged articles may be drawn against the screens, resulting in starvation of the main circulating water pumps. To reduce the velocity to a minimum the area of the screen work and inlet chamber should be as large as possible, bearing in mind capital cost of the latter.

These coarse screens are usually made from timber or mild-steel bars or a combination of the two. In some installations the selection of material for primary screens has been given considerable thought, particularly regarding the possibility of corrosion. Some of the materials considered are copper-bearing steel, Armco iron, mild steel having a coating of cadmium and galvanised mild steel.

It is essential that easy access should be provided to permit of cleaning and repairs to the screens. Small fixed screens are normally hand-raked, but mechanical raking machines may be used where large quantities of debris have to be handled.

Mr. T. H. Carr

Use of Sea Water

Where cooling water is drawn from the sea special tunnels are laid below the sea bed with shafts at either end. A gunmetal screening grid is fixed to each inlet shaft to prevent the ingress of large floating debris to tunnels. In one installation lignum-vitæ cut into V-shaped blocks was used as the straining medium at the pump house shafts.

Travelling screens, which may be either of the twin-flow or uniflow types, are used where there are large variations in water levels. Revolving screens, of which the disc, cup and drum types are the most common, are used where the variations in water level are relatively small.

The cup screen is a modification of the disc pattern in which the screening medium is arranged circumferentially and forms the periphery of the cup. A much greater screening area is thus obtained. The drum type is not so commonly met with, but has some special features which make it adaptable to certain power station sites. The drum revolves on the circulating water pump suction pipes which serve as trunnions. The complete equipment is placed in the river, and foundation work is reduced considerably. Piles are required for supporting the entire screening plant, but apart from these no other building or civil works are necessitated.

The mechanical or secondary screens should be of the self-cleaning pattern and of robust construction and preferably with individual drive where large units are employed. The materials used in the construction of these screens should be durable and withstand corrosive action. The galvanising of the screening panels and sherardising of mild-steel sections appears to be satisfactory.

Circulating water usually contains large quantities of leaves, twigs, straw, hair and floating wood, although much will depend on the locality. The water passing through the screen deposits the debris on the outer face, and it is then carried up to the top of the chamber. At or near the top of the travel or circular path are fixed water jets which deliver water under pressure and wash off the debris.

The screens may be arranged to have a number of speeds by the inclusion of a variable-speed motor or gear-box. Thus the screens may be speeded up when necessary and so freed from large accumulations of leaves or other floating debris.

In emergency one of the screens may be withdrawn and coarse-screened water allowed to pass into the pump suction chamber. The travelling screens may be fitted with automatic by-pass gates through which, in the event of blockage of the faces, the water passes and prevents collapse. This screen has a steel gate below water level which faces the incoming water; under emergency conditions the gate automatically opens and in this way allows the water to pass through the centre of the screen frame.

The disc screen is not very satisfactory for situations where large quantities of debris have to be dealt with as it soon becomes overloaded, resulting in the safety bolt shearing and causing collapse of the screen frame.

Another type of rotary screen or strainer which is inserted in the discharge pipe to the condenser consists essentially of a wheel enclosed in a watertight casing. The wheel is built up of straining grids or panels and revolves at slow speed and is swept by a series of jets. This rotary pipe-line screen is independent of water levels, reliable, economical and accessible.

For Cooling Towers

Cooling tower systems, although comparatively free from debris, still require some form of screening plant, in order to rid the system of any debris, such as wood chips, rags, etc., which are likely to accumulate during the construction period; a coarse screen is generally provided at the tower end of the suction culvert.

Cast-iron appears to be frequently used for these screens. If the circulating system carries large quantities of paper or small wood chips, particularly during the initial filling up, it may be necessary to fix a series of two or three fine screens at the entrance to the pump suction chamber. Should the cooling towers be situated near trees, trouble may be experienced from falling leaves if fine screens are excluded.

Space Heating (*Concluded from opposite page*).

1,339 BThU for one degree (representing the loss specified above) indicates an increase of temperature of 19 deg. F.

This rise occurred over a period of six hours, so that the electricity consumed, as determined from the meter reading, or calculated by multiplying 25,900 (BThU input) by 6 (hours) giving a product of 155,400 BThU which when divided by 3,415 (BThU producable from one kWh), equals 46 kWh. Thus with electricity at 0.75d. per kWh the actual operating energy cost for six hours is 2s. 10d., including the meter rental, whereas with an orthodox boiler installation for similar duty the minimum coke consumption would approximate to 1.5 cwt., which, at 42s. per ton for fuel delivered would increase the running cost to 3s. 3d.

The total initial cost of the electrically heated water radiators amounted to £42 (pre-war) as compared with a highly competitive tender for an orthodox boiler installation costing £52, control in this case being by two immersion type thermostats. Thus the saving effected by heating the church electrically has been 20 per cent. initially and 18 per cent. in respect of operating cost without counting the saving in cost of a caretaker's wages, now dispensed with. In addition the weight of metal saved by using "Ultro" steel water radiators was 9 cwt.

This kind of electric heating will not, of course, reasonably compare with coke-fired installations on a large scale. But electric hot water radiators have much to commend them as satisfying definite needs; for instance, those of the smaller installations when the boiler, pipes, accessories and the troublesome inconvenience of maintaining heat more than offset any possible slight advantage in respect of fuel economy, while the fact that they are produced of pressed steel enables them to be very compactly designed, making them very appropriate to small churches, halls, large and small air-raid shelters, army huts and similar kinds of buildings.

SPACE HEATING

Pressed-steel Water Radiators Individually Heated Electrically

NEXT to the warming of buildings by inducing hot air flow through under-floor ducts, the circulation of hot water is believed to be the oldest artificial means of central heating. It is declared to be one of the most extensively employed systems in this country.

The earliest installations consisted of looped pipes from which the present-day slender-column type of radiator has been developed to satisfy progressively exacting demands. Actually, however, on account of the concentration of the heating surface its shape or form tends to obstruct the greater portion of the radiation emitted so that more often than not radiators of this kind function chiefly as air-warming devices.

The comparatively recent utilisation of panel-like heating surfaces has directed attention to certain advantages that follow from the resulting increased proportion of the total heat dissipated which is emitted by radiation. It appears to have been definitely established that the employment of flat-plate surfaces at moderate temperatures is generally accompanied by an appreciable saving in fuel. Nevertheless, this claim cannot be regarded as an inevitable accompaniment of panel heating.

Typical installation of pressed-steel water radiators in a small church

A just comparison between alternative methods of warming ought not to take into consideration direct issues only ; indirect factors cannot altogether be ignored and, moreover, it does not necessarily follow that the basis of proper comparison should be the emission of an equal amount of heat within the premises or selected rooms. Rather should the criterion be the provision of an equally satisfying degree of comfort for the occupants as a whole, though it is admitted that such procedure will remain extremely difficult until those chiefly concerned, or best fitted to do so, mutually reach such conclusions as will enable the conditions and limits of a standard measure of comfort to be adequately defined.

Heat Loss in Pipes

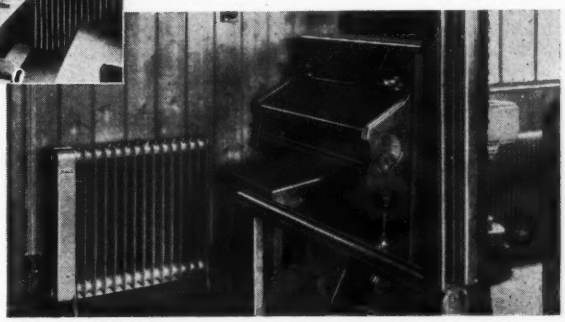
However, the ideal is never really attainable, so it is well to bear in mind that efficacy is commonly preferred to pure efficiency, especially as cost is so frequently, though often erroneously, considered largely to determine what is deemed to be effectual. For example, the quantity of heat transmitted from uninsulated main conveyance pipes and branch feeders is seldom less than 20 per cent. of that transmitted by the radiators served by them ; in extreme cases it often exceeds 50 per cent. and an allowance of 30 per cent. for pipe losses represents average expectation.

Sometimes the heat otherwise wasted in this way can be usefully employed. It is, however, quite easy to avoid the necessity for expensive piping and accessory fittings altogether simply by heating individual radiators electrically, each being fitted with an immersion type element that is plugged into a separate skirting socket outlet. Hot water radiators of this pattern, of two or three different makes, have long been available. Those offered are usually made of cast-iron, whereas abroad steel radiators have been quite extensively advocated and are now obtainable in England from Ultro Heat, Ltd., one of whose claims is that convected heat liberated in this manner is capable of maintaining a uniform 25 per cent. higher space temperature than is possible with electric fires of equal loading.

The company, being actively engaged in the provision of what is regarded as orthodox as well as electric heating, has been impressed, at any rate when dealing with the transmission of heat from water radiators, with the necessity for properly checking electrical input and output deductions. It is wrong to imagine merely because of the introduction of a certain electrical input that the BThU output equivalent is bound to be the same. That is by no means all there is to it. Modern methods of ensuring the desired emissivity of radiators at varying water temperatures and the practice generally adopted nowadays of calculating accurately the losses of heat from buildings to be warmed are exacting.

Advantages of Steel

Steel radiators 3 in. wide are recommended as being one-third of the weight of their cast-iron equivalents, slightly cheaper per sq. ft., easier to install, hardly liable to be damaged by frost when not in use and dust is less likely to adhere to their smoother surfaces.



A sample radiator of this type has been subjected to 17 deg. of frost without becoming distorted or suffering harm in any way. All are given a water pressure test at 100 lb. per sq. in. and, further, steel radiators have been taken down abroad (in Sweden) after over twenty years service without revealing corrosion of any practical significance. Indeed, the only place where this kind of deterioration could occur (where both air and water can be present together) is the inch or two at the top where adequate room has to be left for expansion, and even this is guarded against by special treatment. Each has an immersion element extending substantially the whole length of the radiator horizontally at the bottom, its length making possible a low wattage density per sq. in. and so lengthening the element's life. Thermostatic and/or time switch control of the radiator is advised.

The radiators are filled with water and specially sealed before leaving the maker's works, thus obviating any need for replenishment. Fixed and movable models are obtainable, all dispatched with a priming coat only, to be finished according to customers' requirements. In some cases they are dipped in black enamel, which is of good appearance as well as helpful in assisting radiation. They are of compact design, since they are formed by pressing, and quick initial heating-up is assured by the minimised individual water content.

Calculating the Cost

Turning to the cost aspect, the case of a small church may be cited, the heat losses from which amounted to 1,116 BThU per hour, plus 20 per cent. allowed for its north aspect, or a total of 1,339 BThU per hour for one degree temperature rise. This is the amount of make-up heat that is needed to compensate for that lost whatever heating medium is chosen. Seven " Ultro " radiators were installed to transmit at a predetermined water temperature 25,900 BThU per hour. Dividing this figure by

(*Concluded at foot of opposite page*)

ELECTRICITY SUPPLY WORKERS

Employment of Women: Work during Air Raids: Shift Men's Pay

THE temporary employment of women during the war was one of the subjects considered at the last meeting of the National Joint Industrial Council for the Electricity Supply Industry. A report had been presented to the Negotiating Committee of the Council by Messrs. A. H. Banks, Employers' Industrial Adviser, and T. Cochrane, Trade Unions' Secretary, reviewing the practice with regard to women's wages and conditions in a number of industries.

The Negotiating Committee, having considered this report, has drawn up an agreement which is being circulated to all constituent members of the Council. The agreement states that in order to meet the abnormal conditions arising out of the war women may be employed temporarily in the electricity supply industry on work normally performed by men. This shall be regarded as an emergency measure only and shall not be continued beyond the date of return of the male employees from war service or other approved service in connection with the war, except in the case of women who were employed on September 3rd, 1939.

Women shall be paid 90 per cent. of the men's rate during a probationary period of six months (except where special probationary periods and rates are already specified for men); thereafter women who are able to carry out the same amount of work as the men they replace, without additional supervision or assistance, shall be paid the hourly wage rates fixed for men of the same grade.

The normal working hours for women may be less, at the option of the undertaking, than those fixed for men, in which case overtime rates will be paid for hours worked beyond the reduced number. Particulars of the reduced working hours are to be reported to the appropriate District Council. Subject to the provisions of this clause the working conditions set out in the District Councils' schedules shall apply to women. Women under 21 years of age shall receive the same percentage of the adult women's rates as is provided for in the case of men.

Particulars of the employment of women shall be given to the appropriate District Councils and these Councils will, in the first place, determine questions arising in the application or interpretation of the agreement, the National Council acting in the event of the District Councils' failure to come to a decision.

Working during Air-raid Warnings

Another agreement drawn up by the Negotiating Committee relates to the question of air-raid warnings during working hours. It provides that undertakings shall allocate watching posts with such means of signalling and protection as are reasonably practicable in connection with power stations, substations and other depots in which more than thirty men are employed. The undertaking and the men employed shall agree where the watchers are to be posted and the undertaking will afford facilities for the training of watchers and guarantee them against any loss of wages in this connection.

Upon the receipt of an air-raid alarm watchers will proceed to their posts; other employees are expected to continue at their work until the watchers give warning, when they will proceed to their shelters. No deduction will be made in respect of time lost due to taking shelter after the watchers' warning but no payment will be made in respect of time spent in shelters prior to their signal.

Employees whose continuance at work is essential to the operation of the power station or substation, and who are previously designated for that purpose, will continue at their posts. All practicable precautions will be taken by the undertaking to protect such men. Men working at premises at which watchers are not provided may take shelter upon the sounding of an alarm in the area in which they are working and no deduction will be made from their pay. If a warning continues in operation after working hours, time spent in sheltering after stopping time will not be paid for except in the case of men who have been instructed to work beyond the normal hours who will be paid the single time rate while sheltering.

In view of the concentrated attacks on London, the No. 10 (Greater London) District Council has agreed that relieving shift workers, if not more than two hours late and able to satisfy their employers of their inability to arrive sooner, shall be paid for the lost time. It is recommended that shifts shall be rearranged to meet the conditions. Shift workers were being paid a penny per hour in addition to their grade rate; this has been increased to 2d. per hour for the period of the war.

Re-zoning Applications

At the same meeting of the Council applications for the rezoning of several undertakings were considered. It was resolved that a claim for the raising of Cheltenham from Zone C to Zone B had not been established. On the other hand, an application for the transfer of Gloucester from Zone C to Zone B was approved. to take effect from the first full pay period following October 7th.

A claim for the re-zoning of the Weston-super-Mare undertaking from D to B was referred back to the No. 6 District Council for reconsideration. Consideration of the re-zoning of the Stourport power station from B to A was adjourned pending the receipt of further information from the secretaries of the No. 5 District Council. It was reported that West Bromwich had been transferred from Zone B to Zone A.

Payment of Shift Workers

The report of the Negotiating Committee referred to applications for extra pay for electricians transferred from day to shift work. It was pointed out in a statement received from the No. 12 District Council that Clause 6 of the No. 12 Schedule gave employers the right to transfer men from day to shift work at seven days' notice, extra rates being paid only during the currency of the notice. The District Council sought to surmount the difficulty by creating a new grade of "apparatus maintenance electrician" under the heading of shift workers in the schedule and it asked for the National Council's approval. The Committee resolved that the District Council had the right to create a new grade in its schedule.

No. 8 District Council presented a claim from the employees' side for 2d. an hour extra for shift workers, based on the general fact that such men have to work abnormal hours as compared with day workers. The employers' side of the No. 6 District Council put forward two references on the same subject.

The Negotiating Committee considered the whole question in a general way and passed a resolution expressing the opinion that the time had arrived when consideration should be given to the relationship of shift and day rates in the various district schedules and recommending the National Council to authorise an investigation into the matter with a view to making recommendations to the District Councils.

Other Matters

It was reported at the meeting that the Worthing Corporation had declined to receive a deputation from the National Council on the subject of the Corporation's withdrawal from the No. 11 District Council. It was decided that the attention of the Ministry of Labour should be drawn to the matter. A reply was still awaited from the Chichester Corporation regarding the receiving of a deputation from the National Council upon the same subject.

The following undertakings have joined the appropriate District Councils:—Central London Electricity, Ltd., Metropolitan Electric Supply Co., Ltd., Notting Hill Electric Lighting Co., Ltd., London Electric Supply Corporation, Ltd., and Trent Valley and High Peak Electricity Co., Ltd.

The Council considered a letter from No. 10 District Council on the suspension of trade restrictions during the war which arose out of representations made by the Electricity Commissioners for the release of skilled men from the industry for armament work. The employers' side considered that in order to release the maximum number of men no trade restrictions should stand in the way of replacing them by other persons capable of doing the work. The Trade Union side thought that adequate safeguards were necessary and suggested that the matter was one for the National Council to deal with.

The latter resolved that "the present time is not opportune to take into consideration the question of dilution for the industry."

COMMERCIAL and INDUSTRIAL NEWS

New E.D.A. Films. Factory Lighting Advice. Cable Makers' Wages

Food-Economy Films

TWO new films have been produced by the British Electrical Development Association and a third of electrical interest by the Council for Health and Cleanliness for use in the non-theatrical film programmes provided by the Ministry of Information. Their object is to assist the Ministry of Food in its efforts, in conjunction with the Board of Education and local educational authorities, to encourage the economical use of food in wartime. The first E.D.A. film (a G.B.I. production directed by Chas. Saunders) is intended to increase the use of milk. It indicates, by means of diagrams, the bone-forming and body-building properties of milk and describes its production of clean milk in the modern electrified dairy-farm, the whole being linked together by an appropriate story. Owing to the prior claims of the Forces on milk supplies for the time being, however, the film will not be generally released yet.

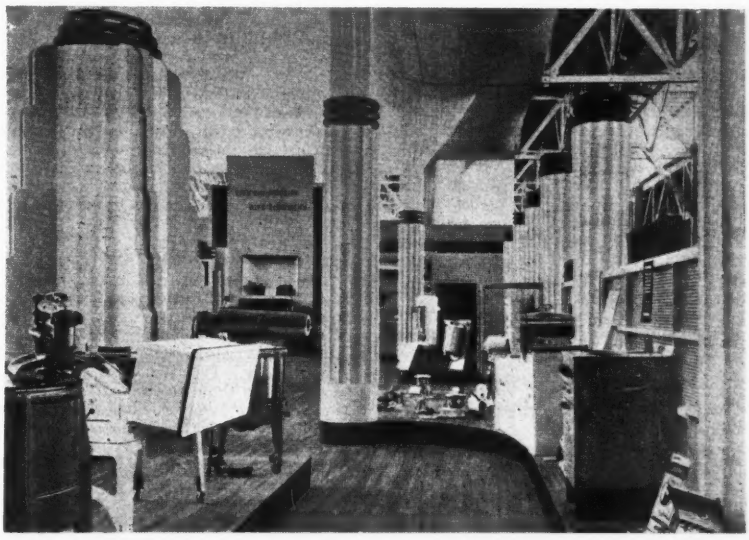
The second, "The Wisdom of the Wild" (also G.B.I. directed by Mary Field), is one of the "Secrets of Life Series." The first half consists of close-up scenes of the feeding habits of creatures such as the leaf-cutter bee, sparrow-hawk, badger, shrike, squirrel and sand wasp. The chief lessons to be learned by human beings are shown to be the intelligent adaptability to necessary changes of diet and avoidance of waste by the so-called "lower creations." These films, which take about ten minutes each to run, may be obtained from the Electrical Development Association, the Ministry of Information or the Ministry of Food.

Wages in the Cable-Making Industry

The Joint Industrial Council for the Electrical Cable Making Industry announces that the cost-of-living figure on November 1st (92 per cent. above the 1914 level) will involve an increase in wages on the third pay day in December in respect of the period for which payment is made on that day. The new rates are as follows:—Male time workers (21 years of age and over): Varying from 66s. 7d. to 74s. 5d. in District No. 1, and from 60s. 6d. to 68s. 6d. in District No. 2. Youths and boys under 21 years of age (time workers): From 17s. 7½d. to 54s. 10d. in District No. 1, and from 17s. to 51s. 6d. in District No. 2. Females, Districts 1 and 2: From 17s. to 21s. 6d. for girls of from 14 to 17 years of age and from 34s. 6d. to 38s. 6d. for women of 18 and over. The scales for females do not include any service bonus that may be due.

New Zealand Centennial Exhibition

To commemorate fifty years of electricity supply in Wellington, the City Electricity Department has issued a handsomely-produced brochure containing illustrations of the Electrical Court at the New Zealand Centennial Exhibition in which the associated electricity supply authorities and the Public Works Department of New Zealand combined to present a comprehensive display. The exhibits, which covered a wide area, were divided into sections, each indicating one of the many uses to which electricity can be applied. There was also a great deal of historical interest on view, including portraits of electrical pioneers and pictures showing the development in Wellington during the past fifty years from which it is interesting to note that the original electricity supply was generated by water power. The brochure contains informative data showing the output of electricity in New Zealand during 1939-40. These particulars show that the total capacity of generating stations in New Zealand is 395,742 kW, total sales 1,300 million kWh and total number of consumers 425,000, while the consumption per head of population is 860 kWh.



A view of the combined electrical exhibition at the recent New Zealand Centennial Exhibition showing the domestic appliance section

Factory Lighting Service

We have already referred to the new Factory Lighting Regulations, issued by the Ministry of Labour and to the National Industrial Electric Lighting Service, under the chairmanship of Sir Duncan Wilson, formed by various associations in the electrical industry, including B.E.A.M.A., E.D.A., C.M.A., E.C.A., E.C.A. of Scotland, E.L.M.A., E.L.F.A., I.M.E.A., and the Incorporated Association of Electric Power Companies. The object of this service is to advise factory executives on the best and most economical way of complying with Section 5 of the Factories Act, 1937, and with the new regulations.

In a circular letter to employers the National Industrial Electric Lighting Service points out that compliance with these

Mr. C. W. Sully's Retirement

THE announcement of the retirement of **Mr. C. W. Sully** from the position of Director of the Electric Lamp Manufacturers' Association, which he had held since 1923, will be received with sincere regret by the whole industry. His connection with electrical affairs has been virtually life-long, for after an apprenticeship with the Midland Railway locomotive shops he went to Crompton's, of Chelmsford, as a pupil in 1892. Eighteen months of battery work with the New York Edison Company followed, and then came a long spell in South Africa, first as representative of Hubert Davies and Co., then acting for Siemens Bros. & Co. In 1910 Mr. Sully returned to England as export manager for Siemens, and after visits to Canada, Australia, New Zealand, and Malaya on their behalf went to the Siemens Lamp Co. in London. In 1914 the first meetings of the Tungsten Lamp Association were held, and on April 17th, 1918, Mr. Sully and Mr. J. Y. Fletcher were present when the E.L.M.A., replacing the T.L.A., was formed. In the following year Mr. Sully was appointed to the main Committee; later in the year he became vice-chairman of the Association, and he was chairman for 1920; in 1923 he was appointed Director. Thus he has been connected with the T.L.A. and the E.L.M.A. for over a quarter of a century.

Mr. C. W. Sully

To mark the occasion of his retirement, a luncheon was given at the Connaught Rooms on November 19th, by his colleagues on the E.L.M.A. Council, members of the Lighting Service Bureau, and the members of the various committees associated with these two organisations, Mr. J. Y. Fletcher presiding. In presenting Mr. Sully with a silver salver engraved with facsimile signatures, and a complete set of the "Encyclopædia Britannica," Mr. Fletcher, after referring to the early days of the two Associations, said that it was very largely due to Mr. Sully's ability, tact, and honesty of purpose that the E.L.M.A. was now regarded as a model of what a trade association could be and could achieve; he wished him many happy years of leisure.

In responding to the toast, Mr. Sully briefly sketched the growth of the E.L.M.A. and of the Lighting Service Bureau, and disclaimed sole responsibility for their success, much of which was due to the services rendered by the various committees. Mr. E. Coote, who had been a member of the Sales Committee since its inception, and is the doyen of the lamp industry, also spoke in appreciative terms of his long association with Mr. Sully. The proceedings ended with a vote of thanks to the chairman, proposed by Mr. C. Hughes.

provisions generally involves technical considerations, and while many employers have either competent lighting engineers of their own or may prefer to engage the services of independent advisers, others, it is believed, will be glad to avail themselves of the guidance offered by the Service. In the latter case any employer who is doubtful whether his present installation conforms to the requirements of the Act and the regulations should call in his usual lighting adviser or apply to the Service. A qualified illuminating engineer will then be sent to examine the conditions and draw up a scheme for improved lighting most appropriate to the circumstances of the particular factory and with due regard to keeping the cost as low as possible consistent with efficiency. No charge will be made for this service.

On the receipt of the scheme it will be open to the employer either himself to engage a contractor to carry out the necessary alterations, or to apply to the Service to nominate one. In the latter case it has been arranged to work on a rota system. The head offices of the Service are the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, but there are local offices in the following towns: 29, Vincent Place, Glasgow; Commercial Union Buildings, Pilgrim Street, Newcastle-upon-Tyne; Circle House, 29, Lady Lane, Leeds, 2; 1, Dickinson Street West, Manchester; and 111, New Street, Birmingham. With the circular letter the Service is issuing a leaflet explaining the provisions of Section 5 of the Factories Act, and the new Lighting Regulations.

Battery Price Control

With reference to the paragraph on this subject which appeared in our last issue, it should be noted that the maximum selling prices given may be increased by the amount of Purchase Tax paid. The makers included in the schedule to the Dry Batteries (Prices) Order as British manufacturers of "Class A" batteries are the following:—Alpha Accessories, Ltd., Britannia Batteries, Ltd., A. C. Cossor, Ltd., the Chloride Electrical Storage Co., Ltd., the Ever Ready Co. (Great Britain), Ltd., the General Electric Co., Ltd., the Gramophone Co., Ltd., Invicta Radio, Ltd., the Marconiphone Co., Ltd., Oldham & Son, Ltd., Pye, Ltd., Siemens Bros. & Co., Ltd., Sterling Batteries, Ltd., and Vidor, Ltd.

An Order made by the Board of Trade places a ban on the sale of torch batteries subject to conditions as to the purchase of other goods and it prohibits a trader from refusing to sell batteries if he has them in stock. When asked to do so a trader must state separate prices for a battery and any article associated with it. If it is the normal trade custom to refuse to sell a battery separately or if a trader has made arrangements for the orderly distribution of batteries to his regular customers the prohibition will not apply.

Extension of Service

The Nottingham Electricity Committee has recommended that employees of the Department reaching the superannuation age of sixty-five shall be retained for a further twelve months to surmount the difficulty of finding men to replace them.

Hogan and Wardrop

Mr. F. Wardrop, joint managing director of Hogan & Wardrop, Ltd., wholesale electrical suppliers, has decided to retire and the business carried on by the company has since November 1st been taken over by Mr. J. R. Hogan, the other joint managing director, trading in the name of Hogan & Wardrop, with the assistance of the same staff. Deliveries are still being made of R.E.A.L. industrial lighting equipment and bowl fires; S. Simister's "Washwell" electric wash boilers and water boilers for canteens, &c.; McClure & Whitefield "Mersey" DC motors and generators; and "Tireless Tim" cylindrical vacuum cleaners. It is hoped to resume relations with the three principals in Holland when the international situation improves. The new address of the company is Fulwood House, Fulwood Place, Holborn, London, W.C.1. (Telephone: Chancery 8986.) The winding-up of Hogan & Wardrop, Ltd., is recorded in the "Financial Section" of this issue.

South Wales Power Co.'s Application

In the King's Bench Division on November 18th, the South Wales Electric Power Co. made an application for leave to apply for an Order prohibiting the Electricity Commissioners from laying down certain requirements as a condition of their granting the company a Special Order. The company wishes to raise fresh capital and the Commissioners have stipulated that it must not proceed under the Order until the terms of issue of the new capital have been approved by them. Mr. Craig Henderson, K.C., who appeared for the company, maintained that the Commissioners had no power to impose such a condition. The Divisional Court granted motions for prohibition and mandamus to be heard at a later date.

An Export Guide

We have received from W. S. Crawford, Ltd., 233, High Holborn, London, W.C.1, a copy of a brochure on "Planning for Export." The introductory section of this stresses the vital character of export trade to this country. The effects of the British blockade are then reviewed to show what supplies from enemy countries and enemy-occupied territories to world markets are not now available. Market investigation and methods of procedure are then discussed. An interesting table giving figures of the 1938 exports from the United Kingdom and Germany to other countries is included. Copies can be obtained by those interested in the matter from Messrs. Crawfords.

Release of Utility Employees

The General Purposes Committee of the London and Home Counties Joint Electricity Authority refers to communications from the Chief Administrative Officer of the London Civil Defence Region stating that arrangements are being made to secure the release from the Services of skilled and semi-skilled men who are needed for the work of restoring damaged public utility works. Application can be made by a responsible officer of a utility undertaking to the London Civil Defence Region which will satisfy itself of the necessity for an employee's release.

A War Savings Example

Cable and Wireless, Ltd., has decided to continue during 1941 the facilities afforded to its staff throughout the entire world, to invest in National Savings Certificates and Defence Bonds. The company advances the amount required at the beginning of each year and recoups itself by monthly deductions from salaries. Since the scheme was started approximatcly £697,000 has been invested in various Government loans and National Savings Certificates.

The Company recently gave an outstanding lead to large organisations by investing £1,000,000 in 2½ per cent. National War Bonds in connection with the War Weapons Week organised by the Borough of Westminster, where its head office is situated.

Corrections

The advertisement of the Lancashire Dynamo & Crypto, Ltd., in our last issue referred to the main geared-motor unit in a tinplate mill. By a printer's error the rating of this machine was given as 3 HP instead of 30 HP.

In the editorial section of the same issue (page 62) we referred to "dynamos" supplied to Ceylon by this company and Crompton Parkinson, Ltd. It has been pointed out that the term "alternators" would have been more accurate; we agree.

Trade Announcements

Electro-Mechanical Supplies, Ltd., are now operating from temporary offices, c/o David Hollander & Sons, 124-128, Barr Street, Birmingham (telephone: Northern 2022), and ask for catalogues and lists from manufacturers.

The Jackson Electric Stove Co., Ltd., announces that its London office at 143, Sloane Street, S.W.1, will be open from 9 a.m. until 4.30 p.m. from Monday to Friday, closing on Saturday.

Change of Address

The Barber Switchgear Co. has removed to a temporary address at 217, Holiday Street, Birmingham, 1, and asks for electrical catalogues.

Catalogues and Lists

M. & C. Switchgear, Ltd., Kirkintilloch, Glasgow.—Illustrated pamphlet (K 112/23) technically describing a flame-proof remote controller incorporating a contactor and step-down transformer for mining drills.

Medical Supply Association, Ltd., 167, Gray's Inn Road, London, W.C.1.—Illustrated and priced leaflet (RSC840) descriptive of the "Restor" lamp-heated cage for use in shock resuscitation.

British Insulated Cables, Ltd., Prescot, Lancs.—Coloured folding leaflet (M.113) which by the correct imposition of the halftone illustrations, combined with the sequence of the folds, reveals by unfolding adaptations of the B.I. detachable-pocket type disconnecting cable network box introduced in 1934.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

KOMET imitation coal fire, flickering.

EVER READY sunshine carbons (British distributors).

SYRENE hair dryer.

Trade Mark Applications

AMONG recent applications for British trade marks are the following, objections against any of which may be entered within one month of November 20th:—

CARP. No. 612,660, and CROW, No. 612,661. Class 2 (IV). Materials composed principally of synthetic resin sold in the form of sheets, rods, tubes or blocks. Ellison Insulations, Ltd., Wellhead Lane, Perry Barr, Birmingham, 20.

HOBSON. No. 609,836. Class 7 (IV). Sparking plugs. H. M. Hobson (Aircraft & Motor) Components, Ltd., 47-55, The Vale, Acton, London, W.3.

RESISTANCE CALCULATIONS

Delta-Star and Star-Delta Transformation Method

By G. W. Stubbings, B.Sc., A.M.I.E.E.

THE simplest rules for resistance calculations are comprised in the formula :—Add the resistance of a series combination to obtain the combined resistance, and add the conductances of a parallel arrangement to obtain the combined conductance. These rules suffice for the majority of resistance problems that the practical engineer has to solve. Although the most complicated arrangement of resistances can be completely solved by the application of Kirchoff's laws, the algebra involved is troublesome and liable to error excepting in the hands of experienced computers. Hence the utility of the delta-star and the star-delta transformations, whereby a delta arrangement can be converted into an equivalent star and *vice versa*.

A simple example of the utility of these transformations is found in the apparently simple problem of finding the resistance between the points A and D of the Wheatstone bridge network of fig. 1 (a). This problem is insoluble by the ordinary series and parallel rules, but, if the ABC delta is replaced by the equivalent ABC star of fig. 1 (b) the problem yields at once to these rules.

Fig. 2 shows a combination of resistance units having ohmic values R_1, R_2 and R_3 connected in delta, and a star combination of which the ohmic values of the components are r_1, r_2 and r_3. The delta and star combinations are said to be equivalent when the resistances between any two corresponding terminals of the two combinations are equal. It follows as a corollary from this definition that if a delta and a star combination are equivalent the resistance between corresponding terminals and the other terminals short-circuited will be the same for the two combinations.

The rules for the two transformations can be established informally in a very simple way, and these rules can be stated in a symmetrical form in which they can be very easily remembered. Consider the two combinations of fig. 2 of which the components of the delta are known. The resistance of the star between A and C is r_1+r_3. The corresponding resistance of the delta is R_1 in parallel with R_2 and R_3 in series. This is plainly $R_1R_2+R_1R_3/(R_1+R_2+R_3)$ which can be put in the form $R_1R_2/R_s + R_1R_3/R_s$, where R_s is the series resistance of the three components of the delta.

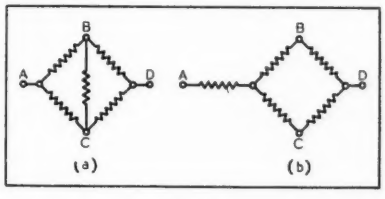


Fig. 1

If the resistances of the two combinations between terminals A and B are similarly worked out, these are r_1+r_2 for the star and $R_1R_2/R_s+R_2R_3/R_s$ for the delta, from which it appears that the common terms in each pair of resistances correspond. Thus $r_1=R_1R_2/R_s$ and, by symmetry, it is evident that $r_2=R_2R_3/R_s$ and $r_3=R_3R_1/R_s$.

We thus have the following rule : The resistance of the component of an equivalent star combination from a terminal of a delta combination is equal to the product of the delta resistances connected to this terminal divided by the series resistance of the delta.

The reverse transformation, from star to delta, can be informally proved in the following concise way, by using the conductances G_1, G_2, G_3 and g_1, g_2, g_3 of the components. Consider the conductances of the two combinations between terminal A, B and C short-circuited. This conductance for the delta combination will be G_1+G_2. For the star the combined conductance will be that of a conductance g_1 in series with one having the value g_2+g_3, and the combined conductance will be $g_1g_3+g_1g_2/(g_1+g_2+g_3)$, which is equal to $g_1g_3/g_p+g_1g_2/g_p$, where g_p is the parallel conductance of the three components of the star combination. It therefore appears that G_1, the conductance of the delta component between A and C, corresponds to g_1g_3/g_p or converting the resistance values $R_1=\frac{r_1r_3}{r_p}$, where r_p is the parallel resistance of the three star components.

We thus arrive at the following rule : The resistance of the component of an equivalent delta combination between two terminals is equal to the product of the star resistances between these terminals divided by the parallel resistance of the three star components. As an aid to memorising these rules it may be noted that, as a delta network is essentially a series combination, given a delta we use a series resistance for transforming to star, and that, as a star network is like a parallel combination in that the components are joined together at the star point, given a star we use a parallel resistance in transforming to delta.

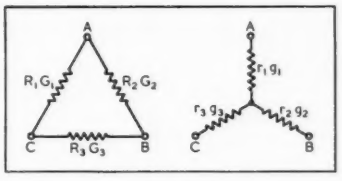


Fig. 2

The star to delta transformation leads to a very convenient formula for calculating the power absorbed in a non-inductive star connected load supplied from a balanced three-phase system of line voltage V. This power will be equivalent to that which would be absorbed in an equivalent delta combination. Using the expressions for the equivalent delta components we find that the total power in the star connected load is

$$V^2r_p\left(\frac{1}{r_1r_2}+\frac{1}{r_2r_3}+\frac{1}{r_1r_3}\right) = V^2r_p\left(\frac{r_1+r_2+r_3}{r_1r_2r_3}\right)$$

$$=\frac{V^2r_pr_s}{r_1r_2r_3}, \text{ where } r_s \text{ is the sum of the star resistances.}$$

This final formula is easily remembered ; it involves the series and parallel resistances of the star and the product of the separate resistance values. As the expression for power must be the square of a voltage divided by a resistance, the resistance product must appear in the denominator of the fraction.

The star-delta transformation can also be used to obtain the currents and voltages in the star components, for, finding the equivalent delta resistances we can easily find the currents in these components, and the line supply currents which are equal to the actual star currents will, as each pair of delta currents are 60 degrees out of phase, be given by an equation like $I_A^2 = I_1^2 + I_2^2 + I_1I_2$. This method of solving a star-connected load problem is not so elegant mathematically as the solution given by the use of vector algebra and it is probably less concise. It is, however, much simpler and the chances of error are much smaller, and for this reason it is a very useful alternative for the practical engineer.

Food Preservation

ULTRA-VIOLET radiation is most destructive of bacteria within a band of from 2,000 to 2,800 Angstrom units. Mercury-arc lamps, which produce radiations covering the whole ultra-violet region, have two main defects as sterilisers. One is that they consume more power than is necessary ; the other is that they produce heat. A lamp designed to operate at a low temperature and to produce a minimum of ozone, the evolving of which is a further disadvantage of ordinary lamps of this type, is described in *Electrical News and Engineering* of Toronto. It is made from $\frac{1}{2}$-in. tubing of special glass in three standard lengths, 10, 20 and 30 in., and is filled with mercury vapour at low pressure. About 80 per cent. of the total radiation from the arc is said to be at 2537 Au, the point of maximum effect on micro-organisms. The starting voltage is from 400 to 750 V., depending on the tube length. A high-reactance transformer regulates the current to between 0.03 and 0.05 A, and the consumption of the largest size is only 15 W.

ELECTRICITY SUPPLY

New Morecambe Showrooms. Stoke Rejects Contractors' Application

Accrington.—GOOD FINANCIAL POSITION.—The Electricity Committee reports that although the local electricity charges were among the six lowest in the country before the war began, the surplus for the year ended March 31st last was £16,621. A "progress return" shows that last year's surplus brought the total profit for the past 15 years to about £200,000. Mr. A. W. Clegg, electrical engineer, whose services extend over 40 years, is to continue in office at the request of the Committee.

Brighouse.—STREET LIGHTING.—The Corporation has approved a recommendation for the extension of the modified street lighting system, and has decided to expend a further £400 on units for main road junctions and for the centre of the town.

Clitheroe.—PURCHASE OF GISBURN UNDERTAKING.—The Town Council has now agreed terms with Mr. J. H. Tattersall for the purchase of his electricity undertaking at Gisburn. The question of a supply to Slaidburn has been referred to the chairman and vice-chairman with power to act in consultation with the electrical engineer.

Darlington.—LOAN FOR CABLES.—The Town Council is applying to the Electricity Commissioners for sanction to borrow £1,000 for mains and services during the coming twelve months.

Glasgow.—UNSPECIFIED WORKS.—The city electrical engineer having reported that it would be necessary to incur the following capital expenditure on unspecified works during the period from October 1st to May 31st next, the Electricity Committee has authorised the town clerk to make application to the Electricity Commissioners for consent: Mains and services, £13,000; substation equipment, £17,000.

Grimsby.—POSSIBLE PRICE INCREASE.—It was hinted by the chief electrical engineer at a meeting of Electricity Committee on November 12th that if coal and other working costs continued to increase electricity charges must of necessity be raised. Economies had been made, but these would not suffice if costs went up further.

Hull.—CAPITAL EXPENDITURE.—The Electricity Committee is seeking sanction to borrow £5,000 for water heating apparatus and to take from unexpended balances £10,776 for mains and services, £11,513 for substations and equipment, £1,225 for assisted wiring and £1,936 for hire apparatus.

Kirriemuir.—STREET LIGHTING TERMS.—The burgh is again to have modified lighting in the streets, the council having agreed to the Grampian Electricity Supply Co.'s terms of 1½d. per kWh between sunset and 11 p.m. and 1d. between 11 p.m. and sunrise.

Lancashire.—RE-WIRING TECHNICAL SCHOOL.—Sanction has been received by the County Council to a loan of £1,080 for re-wiring and renewing the electrical installation at the Darwen Technical School.

London.—WANDSWORTH.—The Borough Council is to convert 9,869 street lamps for modified lighting at a cost of £10,282.

Milford Haven.—SYSTEM CONVERSION.—The Urban Council is applying for sanction to borrow £1,190 for the change-over of the supply to AC in the Stratford Road area.

Morecambe and Heysham.—NEW SHOWROOM.—The Corporation is to purchase Pedder Street Methodist Church and site for conversion as showroom premises for the Electricity Department.

Sheffield.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £6,227.

Shropshire.—ELECTRICITY FOR INSTITUTION.—The Assistance Committee is to install electricity at the Whitchurch institution at a cost of £275.

Southend-on-Sea.—DECREASED OUTPUT.—At a recent meeting of the Town Council the Electricity Committee reported that in the six months ended September 30th, the total sent out on feeders was 19,920,520 kWh against 32,708,570 kWh in the corresponding period of 1939. The cost per kWh was 0.70d. against 0.51d.

Stoke-on-Trent.—CONTRACTORS' APPLICATION REJECTED.—A request by the Electrical Contractors' Association that the present addition of 10 per cent. to prices for assisted wiring and cooker wiring work should be increased to 20 per cent. has been refused by the Electricity Committee.

SUPPLY SCHEMES.—The Electricity Committee is seeking a Fringe Order to provide an electricity supply for lighting and heating at the new offices of the Whiston Slag Co., Ltd. It has also agreed to supply electricity to a pumping station at a cost of £110. With regard to the Holdcroft dwellings, it has been decided that a supply shall be given to each of these on the multipart tariff at a fixed charge of 1s. 6d. per week up to 240 kWh per quarter, consumption in excess to be at the follow-on rate.

Stretford.—SHELTER INSTALLATIONS.—In accordance with a scheme prepared by the Stretford and District Electricity Board, the Corporation Emergency Committee is to provide lighting and heating at shelters at a cost of £6,447.

One of the trolley-buses acquired from Cleethorpes by the Nottingham Corporation

Warwickshire.—PREVENTING SIRENS FREEZING.—The County Council Emergency Committee, to prevent the freezing up of sirens, has authorised the purchase of thermostatically-controlled electric heaters for 62 electric sirens at a cost of £574.

Overseas

New Zealand.—WELLINGTON.—Mr. M. Cable, M.I.E.E., general manager of the Corporation Tramways and Electricity Departments, has sent us his annual report for the year ended March 31st last. From this it is seen that the revenue rose from £382,560 to £435,702 and the working expenses from £267,862 to £306,012. Capital charges amounted to £85,576 (against £82,707) and special expenditure to £14,489 (£17,626); the net credit balance was £29,624, over double that for the preceding year. The number of consumers increased from 39,507 to 40,429 and the total sale of energy from 95,265,628 to 113,245,513 kWh. The total connected load (including tramways) was 192,207 kW and the maximum load recorded was 35,490 kW.

The report says that the preparations for the Centennial Exhibition and associated celebrations involved many problems in connection with special street lighting and electrical installations at the Exhibition. The main routes to the Exhibition were illuminated by sodium and mercury-vapour lamps and these proved an outstanding feature of the great occasion. The electricity Department contributed £25,000 to the special fund raised to meet the expenditure on the celebrations. Of this £17,000 was expended on street works and the balance was allocated to the Department for street lighting purposes which, however, was exceeded, the excess cost being met by the Department. The anticipated increase in demand for electricity was not fully realised, but the bulk of the increase in revenue was attributable to the Exhibition.

TRANSPORT

Brighton.—RECOVERY OF TRAM RAILS.—A report by the transport manager reveals that the work of lifting and disposing of the tram rails from all the roadways has now been completed. Altogether 2,850 tons of metal has been recovered.

Darlington.—UNDERTAKING'S PROFIT.—The Corporation transport undertaking earned a net profit of £4,055 for the past year compared with £4,982 in the previous year. The number of passengers carried was 18¼ millions, an increase of 11.5 per cent. The Corporation has recently secured delivery of four new trolley-buses.

Nottingham.—PURCHASE OF TROLLEY-BUSES.—All the buses employed by the Corporation Transport Department are of Associated Equipment Co. manufacture and now the Department has added four A.E.C. trolley-buses to its fleet. These have been purchased from the Cleethorpes Corporation which has been operating A.E.C. trolley-buses since 1936.

New Zealand.—WELLINGTON TRAMWAYS.—The report for 1939-40 of the Wellington Corporation Tramways Department (general manager, Mr. M. Cable) shows that the revenue increased by £75,421 to £529,134, while the expenses were only £42,248 greater at £414,246. Thus, although capital charges and special expenditure were higher, the credit balance rose from £1,368 to £26,183. The large increase in receipts was due to the Centennial Exhibition; the number of passengers carried was about 4¼ million more than in 1938-39.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1939

520. "Television receivers of the optical-projection type and other image projection systems." Kolster-Brandes, Ltd., and D. S. B. Shannon. January 6th, 1939. (528444.)

5910. "Electromagnetic apparatus for determining location of concealed bodies." British Western Union, Ltd. February 26th, 1938. (528568.)

9184. "Electric converting apparatus." British Thomson-Houston Co., Ltd. March 23rd, 1938. (528380.)

9643. "Shaving devices." Electric Razor Corporation. March 31st, 1938. (Cognate applications, 9644/39 and 9645/39.) (528510.)

9935. "Electrical production of musical sounds." A. H. Midgley and A. M. Midgley. March 30th, 1939. (528575.)

12197. "High-pressure metal-vapour lamps." Quarzlampen Ges. April 23rd, 1938. (528577.)

12230. "Automatic regulator for arc furnaces." Y. Efraimovitch. April 24th, 1939. (528626.)

12259. "Electrical apparatus for the measurement of mechanical pressures or movements or derivatives thereof." A. C. Cossor, Ltd., T. D. Humphreys and E. M. Dodds. April 24th, 1939. (528451.)

12276. "Gas-blast electric switches." British Thomson-Houston Co., Ltd. April 22nd, 1938. (528452.)

12440. "Electrical ignition systems for internal-combustion engines." L. Barnes. April 25th, 1939. (528383.)

12526. "Pressure gas supply of electric switches." British Thomson-Houston Co., Ltd. April 26th, 1938. (528580.)

12545. "Electrical miners' lamps having two light sources." Friemann & Wolf Ges. April 26th, 1938. (528627.)

12633. "Rotor bearings." Demag Akt.-Ges. May 19th, 1938. (528628.)

12685. "Telephone systems." Fides Ges. für die Verwaltung und Verwertung von Gewerblichen Schutzrechten. April 28th, 1938. (528457.)

12767. "Electric fuses." British Thomson-Houston Co., Ltd. April 29th, 1938. (528629.)

12785. "Amplifying systems." Standard Telephones & Cables, Ltd., R. A. Meers and P. R. Thomas. April 28th, 1939. (528513.)

12786. "Radio direction finding systems." Standard Telephones & Cables, Ltd., and C. F. A. Wagstaffe. April 28th, 1939. (528514.)

12787. "Two-way electrical signal transmission systems." Standard Telephones & Cables, Ltd., and R. Walsh. April 28th, 1939. (528515.)

12809. "Measuring instruments." Telefonaktiebolaget L. M. Ericsson. April 29th, 1938. (528518.)

12819. "Electron discharge tubes." Marconi's Wireless Telegraph Co., Ltd. April 29th, 1938. (528458.)

12828. "Method of and means for starting electric discharge lamps." Hanovia, Ltd., and F. G. A. Haegele. April 28th, 1939. (528460.)

12980. "Audio-frequency amplifiers." Marconi's Wireless Telegraph Co., Ltd. April 30th, 1938. (528631.)

12981. "Thermionic valve amplifiers." Marconi's Wireless Telegraph Co., Ltd. April 30th, 1938. (528632.)

13102. "Telephone transmitters." Standard Telephones & Cables, Ltd. September 24th, 1938. (528523.)

13133. "Mains energised thermionic tube circuits." Electrical Research Products, Inc., and S. H. W. Browning. May 2nd, 1939. (528633.)

13473. "Cabinets for refrigerators." British Thomson-Houston Co., Ltd. May 6th, 1938. (528393.)

13474. "Electric fuses." British Thomson-Houston Co., Ltd. May 6th, 1938. (Addition to 509130.) (528394.)

13475. "Electric air-break power and isolating switches." British Thomson-Houston Co., Ltd. May 7th, 1938. (528395.)

13479. "Fixing of tubes in the walls of receptacles." Allmänna Svenska Elektriska Aktiebolaget. May 19th, 1938. (528396.)

13492. "Printing telegraph exchange systems." Standard Telephones & Cables, Ltd. May 20th, 1938. (528525.)

13521. "Electric acoustic devices." Standard Telephones & Cables, Ltd. May 5th, 1938. (528400.)

13528. "Electrical filter circuits." Siemens Bros. & Co., Ltd., and M. Reed. May 5th, 1939. (528403.)

13529. "Electric supply systems." English Electric Co., Ltd., H. S. Carnegie and J. B. Young. May 5th, 1939. (528404.)

13566. "Electro pneumatic control for priming siphon systems." Incandescent Heat Co., Ltd., and R. W. Haverley. May 6th, 1939. (528415.)

13603. "Method of and apparatus for the televising of kinematograph films." Radioakt.-Ges. D. S. Loewe. May 6th, 1938. (528424.)

13605. "Thermionic valves." Mullard Radio Valve Co., Ltd. May 9th, 1938. (528425.)

13656. "Current collectors for electric vehicles." F. Cook, H. E. Witts and London Passenger Transport Board. May 8th, 1939. (528434.)

13697. "Illuminated display apparatus." J. Taddonio. May 8th, 1939. (528470.)

13705. "Electrical oscillators adapted to generate very high frequencies." General Electric Co., Ltd., and M. R. Gavin. May 8th, 1939. (528473.)

13707. "Combinations of high pressure metal-vapour electric discharge lamps with circuit elements for operating them." British Thomson-Houston Co., Ltd., and General Electric Co., Ltd. May 27th, 1938. (528474.)

13714. "Methods of suppressing the current to earth in high-tension distribution systems." British Thomson-Houston Co., Ltd. May 10th, 1938. (Cognate application, 13715/39.) (528475.)

13727. "Apparatus for producing endless extended coil structures from wire or strip." Norddeutsche Kabelwerke Akt.-Ges. May 11th, 1938. (528476.)

13728. "Manufacture of insulating tubes for electro-technical purposes." Micafil, Ltd. May 11th, 1938. (528477.)

13738. "Biasing circuits for electron discharge devices." Marconi's Wireless Telegraph Co., Ltd. May 7th, 1938. (528481.)

13745. "Methods and circuits for use in eliminating interference in radio reception." Magyar Wolframlampa Gyar Kremenezky Janos Reszvenytarsasag. May 6th, 1938. (528484.)

13748. "Earthing reactances." J. B. Hansell and Metropolitan-Vickers Electrical Co., Ltd. May 8th, 1939. (528485.)

13781. "Insulators for overhead electric cables or wires such as used for supplying electric current to trolley buses and like vehicles." A. Wiseman. May 9th, 1939. (528494.)

13837. "Electrical stop motions or signalling means responsive to breakage or tension of threads and the like in warping or other textile machines." Photoswitch, Inc. July 28th, 1938. (528543.)

13840. "Vacuum cleaners." Electrolux, Ltd. May 12th, 1938. (528546.)

13850. "Holders for electron-discharge devices." Standard Telephones & Cables, Ltd., and G. R. Wicks. May 9th, 1939. (528548.)

13852. "Electric arc furnaces." L. Tagliaferri. May 16th, 1938. (528549.)

13858. "Luminescent materials, and electric discharge lamps comprising them." General Electric Co., Ltd., H. G. Jenkins and A. H. McKeag. May 9th, 1939. (528552.)

13859. "Safety devices for electric lamps adapted to be operated in explosive atmospheres." General Electric Co., Ltd. (Patent Treuhand-Ges. für Elektrische Gluhlampen). May 9th, 1939. (Cognate application, 24490/39.) (528553.)

13860. "Electric motor control systems." General Electric Co., Ltd., and E. H. Crcft. May 9th, 1939. (528554.)

13911. "Method of and means for rectification of alternating electric currents." J. C. Shaw. May 10th, 1939. (528592.)

13962. "Manufacture of electric lamps." British Thomson-Houston Co., Ltd., and W. J. Scott. May 10th, 1939. (528603.)

13971. "Aerial systems." Telefunken Ges. für Drahtlose Telegraphie." May 11th, 1938. (528605.)

13980. "High-pressure metal vapour electric discharge devices." General Electric Co., Ltd., V. J. Francis and J. W. Ryde. May 10th, 1939. (Cognate application. 15190/39.) (528607.)

13981. "Electric switches, and indicating devices therefor." General Electric Co., Ltd., F. Evans and A. E. Jepson. May 10th. 1939. (528608.)

13982. "Electric hot-plates." General Electric Co., Ltd., and G. S. Cattell. May 10th, 1939. (528609.)

14028. "Thermostatic controlling apparatus for cookers." S. Smith & Sons, Ltd., and S. Smith. May 11th, 1939. (528638.)

14029. "Cookers." S. Smith & Sons, Ltd., and S. Smith. May 11th, 1939. (528639.)

14041. "Electric accumulators." Chloride Electrical Storage Co., Ltd., and H. Dean. May 11th, 1939. (528641.)

14076. "Electric measuring instruments." British Thomson-Houston Co., Ltd. May 12th, 1938. (528650.)

14077. "Electric lighting fittings." British Thomson-Houston Co., Ltd., L. Hubble and F. W. Thorpe. May 11th, 1939. (528651.)

14117. "Test benches for electric motors and the like." L. Hartridge. May 11th, 1939. (528655.)

19276. "Automatic traffic controlling apparatus." L. C. Walters and H. Rosen. September 28th, 1938. (528504.)

1940

12302. "Electrical apparatus for the measurement of mechanical pressure or movements, or derivatives thereof." A. C. Cossor, Ltd., T. D. Humphreys and E. M. Dodds. April 24th, 1939. (Divided out of 528451.) (528675.)

FINANCIAL SECTION

New Companies. Capital Returns. Debenture Charges. Bankruptcies and Liquidations. Reports and Dividends. Stocks and Shares

New Companies Registered

I. M. Master Products, Ltd.—Private company. Registered November 13th. Capital, £1,000. Objects: To carry on the business of manufacturers and distributors of, and wholesale and retail dealers in, electrical, radio and mechanical gramophones, radio receiving and transmitting sets, silent and talking picture apparatus, etc. The directors are: A. G. Imhof, 254, Malden Road, New Malden, Surrey, and Mrs. L. H. C. Imhof, 7, Preston Road, Copse Hill, S.W. 20 (directors of Alfred Imhof, Ltd.). Registered office: 112-116, New Oxford Street, W.C.1.

Motor Rewinds & Repairs, Ltd.—Private company. Registered November 16th. Capital £500. Objects: To carry on the business of electrical engineers, electrical installation contractors, manufacturers of, and dealers in, and repairers of, dynamos, motors, armatures, magnetos, batteries, conductors, insulators, transformers, lamps, fittings and accessories, etc. The directors are: H. H. Lamb and Mrs. E. Lamb, both of 37, Rowan Road, Sutton Coldfield, Warwick. Solicitors: Bowman and Evans, 12, Waterloo Street, Birmingham, 2.

Companies' Returns

Statements of Capital

Ever Ready Radio Valve Co., Ltd.—Capital, £1,000 in £1 shares. Return dated August 19th, 1940. 970 shares taken up, £970 paid. Mortgages and charges: Nil.

London Electrical Manufacturing Co., Ltd.—Capital, £600 in £1 shares. Return dated August 27th, 1940. 501 shares taken up. £501 paid. Mortgages and charges: Nil.

Painter & Madew, Ltd.—Capital, £2,000 in £1 shares. Return dated August 24th, 1940. 1,445 shares taken up, £1,085 paid. £360 considered as paid. Mortgages and charges: Nil.

Liquidations

Hogan & Wardrop, Ltd.—Winding up voluntarily. Liquidators, Mr. J. R. Hogan, Fulwood House, Fulwood Place, Holborn, W.C.1, and Mr. R. Stewart, 57-60, Holborn Viaduct, E.C.1. Particulars of claims to be sent to either of the liquidators by December 12th.

The business of this company has been taken over by Mr. J. R. Hogan, trading as Hogan & Wardrop; further particulars of the arrangements are given in the "Commercial & Industrial News" section of this issue (page 90).

Robinson & Hands Electric Co., Ltd.—Meeting November 26th at 95, New Street, Birmingham, to receive an account of the conducting of the winding-up of the company during the preceding year by the joint liquidators, Messrs. H. V. L. Heaven and A. Cripwell.

Wetherill (Radio), Ltd.—Meeting January 14th at 1, Fennel Street, Manchester, 4, to receive an account of the winding-up by the liquidator, Mr. C. Green.

Real Radio, Ltd.—Meetings under Section 245 of the Companies Act, 1929, on December 18th to receive an account of the winding-up by the liquidator, Mr. A. E. Middleton.

Bankruptcies

J. V. Reynolds, electrical engineer, at present serving in the army and described in the receiving order as British Electrical Installation Co., 7, Lambs Conduit Street, W.C.1. and of "Arundel," Totteridge Lane, Hartford.—Discharge suspended for one year and three months until January 15th, 1942.

J. Savill and F. E. Roberts, trading as Commercial Heat, Light & Power Co., electrical engineers, 47, Poland Street, London, W.—The first meeting of creditors was held on November 19th at London Bankruptcy Buildings. The business was started by Savill in September, 1937, Roberts joining as a partner in the following March. The liabilities were returned at £473, against assets of £178. The failure was attributed to the outbreak of war which resulted in the stoppage of contracts, delay in obtaining materials, and rise of prices. The case was left in the hands of the Official Receiver.

H. V. Sore, electrical engineer, Electra House, Sun Street, Hitchin.—Trustee, Mr. T. Pollit, 6, The Parade, Northampton, Official Receiver, released November 5th.

T. P. Wood (a firm), electrical contractors, 28, Queen Street, Ipswich.—Receiving order made November 8th on a creditor's petition.

S. H. Holly, electrician, 4, South Street, Wareham.—Discharged as from November 14th 1940.

H. M. Wise, electrical engineer and radio dealer, Corvedale Road, Craven Arms, Salop.—Discharge suspended for six months until April 21st, 1941.

Reports and Dividends

Crabtree Electrical Industries, Ltd., held its annual meeting on November 21st, when Mr. H. F. McLoughlin, A.M.I.E.E. (chairman), who presided, said that the export markets of their subsidiary operating company, J. A. Crabtree & Co., Ltd., had during the year not only been considerably extended, but had shown substantial increase in volume of trade. The state of both the home and export order books of that company were indeed satisfactory, and never previously had they been in such a healthy condition.

Although increased costs of raw materials and labour have not been entirely avoided, they were fortunate in having available, for preserving continuity of production, such adequate stocks of materials—particularly at a time when supplies in general were not too readily obtainable. Investments in trustee securities showed a reduction of £15,000, the reason for this being that in August, 1939, believing war to be imminent, it was considered prudent to realise a portion of these investments which were repaid at par, in order to have adequate cash available for rapidly building up stocks of raw materials, the prices of which were already then tending to harden. That policy had been fully justified by events during the last year. A considerable part of the proceeds from their investments had been reinvested in war stock.

Electrical Switchgear & Associated Manufacturers, Ltd., report a net profit for the year ended October 31st of £13,018, as compared with £14,213 in the preceding year. The ordinary dividend for the year is maintained at 10 per cent. and £10,609 is carried forward (against £8,803 brought in). The profit of Brookhirst Switchgear, Ltd., the subsidiary, to July 31st, is £57,378, as compared with £28,190 for 1938-39. Tax reserve receives £29,000 and the dividend paid absorbs £11,212. A sum of £3,806 is reserved to cover the balance of the total cost of A.R.P. shelters, £2,140 is added to the welfare fund, and £11,212 is carried forward (against £12,285 brought in). The report of Brookhirst Switchgear states that the turnover was materially increased and the total value of orders received during the year showed a large increase over the figures for the preceding year.

The Carrier Engineering Co., Ltd., reports profits for the year to June 30th of £86,632 as compared with £105,001 for 1938-39, and a net balance of £80,383 (against £100,007). Tax provisions total £25,534, preference dividends £6,750 and second preference redemption £5,000. The dividend on the ordinary shares for the year is 25 per cent. less tax (against 50 per cent.), and £72,269 is carried forward (against £66,669 brought in).

The Madras Electric Supply Corporation, Ltd., has declared an interim dividend of 1½ per cent., tax free (against 2 per cent.)

The Cawnpore Electric Supply Corporation, Ltd., is maintaining its interem dividend at 3 per cent.

Joseph Lucas, Ltd., report a net profit for the year to August 7th of £297,317, as compared with £352,480 for 1938-39. The balance is struck after making provision for tax. As we have already announced, the ordinary dividend for the year is maintained at 15 per cent.; reserve receives £100,000 and £15,000 is placed to the workpeople's funds. The balance carried forward is £65,986 (against £63,703 brought in).

British Industrial Plastics, Ltd., report a trading profit for the year to September 30th of £163,069, an increase of £52,439 over the figure for the preceding year. After providing for taxation, general expenses, research, depreciation and other charges, the net balance is £24,397 (against £22,400). The ordinary dividend for the year is maintained at 8 per cent. less tax, and the balance carried forward is £5,680 (against £3,917 brought in).

The Perak River Hydro-Electric Power Co., Ltd.—Presiding at the annual meeting on November 21st Sir George Balfour (chairman), said that in the previous year they had to record a very bad trading year; the Malayan tin quota averaged 31.6 per cent., and their net earnings were only sufficient to meet capital charges up to and including the preference dividend. A dividend of 2½ per cent. was paid on the ordinary shares, but this was partly provided out of the amount carried forward from the preceding year.

This payment was justified because the returns for the first two months of the new financial year were so satisfactory and they had made liberal depreciation allowances in previous years. The first three months of the current year showed a comfortable increase compared with the corresponding period in the previous year and they might anticipate a satisfactory account when they met next year. The higher efficiency of the new steam plant proved of great value under difficult conditions. As the result of unusual droughts the total output of their hydro-electric plant was for a time only 22 per cent. of its capacity.

(*Continued on page* 97)

STOCKS AND SHARES

TUESDAY EVENING.

THE general trend of Stock Exchange business follows much the same lines as those which have been noticeable for the past few weeks. Occasional set-backs occur; the intensive air-raid activity brought about a pause in business, which, however, had little effect upon prices. The price-lists overleaf show that improvement has been carried into nearly every department. Public appetite for stocks and shares continues keen, and, owing to the restricted conditions under which Stock Exchange markets are now operating, an excess either of demand or of supply exercises a disproportionate effect upon quotations. Rises in Central Electricity issues have lifted the prices from 1 to 1½ points. Home railway stocks pursue a switchback course. After being strong, the prices gave way upon demands from the railwaymen for more wages. Recovery ensued when the three unions agreed to a postponement of their claims.

Equipment and Manufacturing

In this group, the insistent demand for first-rate industrials has brought about an all-round strengthening of quotations. For instance, Callender's, at 60s., Johnson & Phillips, 45s. Siemens, 17s. 6d., Telegraph Construction, 33s. 9d., Cromptons, 17s. 6d., are all decidedly better. Chloride shares have risen to £3 on announcement of the usual interim dividend. Crabtrees are 2s. 6d. up at 22s. 6d. on the statements made at the meeting. The chairman pointed out that he could not go into details, but he stated that the business was showing satisfactory expansion. Associated Electrical Industries have risen to 40s.; General Electrics to 77s.; English Electrics to 28s. 9d.; Ericssons to 27s. 6d.; Hall Telephone to 11s. 3d.

Not all the Story

Other improvements will be noticed by reference to the catalogue, and it must be added that these rises do not give the whole story, because in a number of cases shares are practically unobtainable even at the advanced quotations. Electric & Musical Industries are 9d. down at 7s. 9d., the fall reflecting disappointment with the recent passing of the dividend. British Insulated at 81s. 3d. have put on ½. A number of shares in the iron, steel and engineering companies, which had been participating in the general improvement, halted on the air-raid activities referred to above. Joseph Lucas are a firm market upon maintenance of the dividend at 15 per cent.

Electricity Supply Prices

Upon an optimistic view as to the forthcoming dividend on Yorkshire Electrics, the shares have been in pressing demand from the provinces and at 32s. 6d. the price is 1s. 9d. higher. Midland Counties and Midland Electric Power shares have both advanced. The Scottish shares are also harder; and, in the London group, County ordinary improved to 30s. 9d. The demand for supply shares has spread to those in the Overseas group, where East African Power, Jerusalem Electric, and Kalgoorlies are all harder. Victoria Falls ordinary have risen to 68s. 9d. and the company's preference to 37s. 6d. The company, as explained on previous occasions, can be expropriated in 1950 by the Governor-General, who has to give two years' notice in advance of such intention. It is thought, perhaps without justification, that the preference shares might possibly be taken over at their par value of 20s. But much can happen before the option becomes exercisable. Madras Electric Supply at 25s. are unaffected by announcement of an interim dividend of 1½ per cent., tax free, against 2 per cent., tax free, this time last year.

A Concrete Example

As a concrete illustration of the narrowness of to-day's markets, and the difficulty which exists of obtaining stock, it may be mentioned that in the case of certain shares quoted overleaf there is a buyer in the market of 1,000 at 6d. above the quotation given in our lists. Although he has been trying for the past fortnight to pick them up, the would-be purchaser has been unsuccessful in obtaining the offer of a single share.

Foreign Affairs

Rio Tramway 5-per-cent. bonds, which had risen to within a few points of the highest level touched this year, have lost 5, going back to 85, on a delay in the Government of Brazil remittance of interest which had been expected to arrive earlier in the month, on certain of the Government's obligations. In the market for American utilities the Treasury has just issued a further Order, following upon those of February and April in this year, when holders of specified securities were required to send in their stocks for registration to the Bank of England, in order that they might be taken over by the Government.

Expensive Delay

A good many people neglected to comply with the requisition, and the Treasury has now repeated the list with the intimation that the prices now to be paid are either those current last week, or in the earlier months just mentioned, whichever price is the lower. This imposes a mild penalty upon holders of the requisitioned stocks who had not acted upon the two previous Orders. A certain number of utility issues are included in the lists, holders of which will doubtless make sure, this time, that they fall in with requirements that are framed in the national interest. Anglo-Argentine Tramways debentures are better for the reasons given here on November 8th.

Cable and Wireless

After rising to 57, which is more than 20 points higher than the stock stood at in July last, Cable and Wireless ordinary reacted to 55 on the appearance of a few sellers tempted to take profits upon stock acquired at lower levels. The selling was readily absorbed and the price shows a gain of 2 on the week. Efforts to buy the 5½-per-cent. preference stock led to comparatively little business, but to a gain, also of two points, in the price. The persistence of the purchasers is ascribed to the present-day anxiety on the part of the capitalist to obtain what he deems a living yield on his money, and the continual absorption of the stock has left the market very bare of supply.

Marconi Marine has declared an interim dividend of 2½ per cent.; the same as that of last year. The price of the shares remains unchanged at 20s.

Perak River

The Perak River Hydro-Electric Power is another company that is benefiting materially from the change for the better in the condition of the tin market. In Malaya, where the company operates, the average tin quota was nearly 80 per cent., as against 31½ per cent. in the previous year. Mainly due to this, the company has been able to raise its dividend from 2½ per cent. to 6 per cent., and at the meeting the other day the chairman, Mr. George Balfour, outlined a policy which will make for stability and regular dividends. The price of the shares is unchanged at 15s., at which the yield on the money comes to 8 per cent. on a 6 per cent. dividend basis.

Nigerian Electric

Nigerian Electricity Supply shares have come into notice owing to the increase of consumption during the first eight months of the current financial year. The total to the end of October was 25½ million kW, more than double than that for the corresponding period in the previous twelvemonth. The company holds a Nigerian Government concession to use the waters of five different rivers. It owns hydro-electric stations to provide power for mining companies and the Government. This month an interim dividend of 4 per cent. on account of the year to February 28th, 1941 has just been paid and the price, which had been down to the neighbourhood of 10s., has recovered to 13s. The shares are regarded as a good industrial lock-up for future reference.

The Matter of Indices

By convention, the trend of prices in gilt-edged stocks is usually followed by a similar movement in that for industrial ordinary shares. As is well known, the prices of gilt-edged stocks have been advancing month by month, until at the present time the index figure, as it is called, stands at the comparatively high level of 111. The rise in the latter has been going on since the early part of the year, with an occasional set-back such, for instance, as that caused by the surrender of France to the German invader. From this set-back, recovery quickly followed, but industrial shares have made slower progress, and, although the index figure is substantially above the lowest touched during the present twelvemonth, it is far below its maximum of 1940. By degrees, however, the leeway is being made up, and the difference between the two indices is now about 25 points.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price Nov. 25	Rise or Fall	Yield £ s. d.
Home Electricity Companies							
Bournemouth and Poole	63/6	36/6	15	15	42/6	..	—
British Power and Light	30/–	20/–	7	7	25/–	..	5 12 0
City of London	28/–	20/–	7½	7½	21/3	..	—
Clyde Valley	38/6	34/–	8	8	33/9	+⅛	4 14 10
County of London	43/3	21/–	10½	10½	30/9	+9d.	6 16 7
Edmundson's:							
7% Pref.	32/–	24/3	7	7	28/3	..	4 19 1
Ord.	27/6	18/6	9	6	24/–	..	5 0 0
Elec. Dis. Yorkshire	40/3	32/–	9	9	32/6	..	5 10 9
Elec. Fin. and Securities	42/–	34/6	12½	12½	38/9	..	6 15 0
Elec. Supply Corporation	48/–	39/–	12	11½	37/–	..	6 4 4
Isle of Thanet	16/–	5/6	4	4	6/–	..	—
Lancs Light and Power	33/–	21/6	7½	7½	27/6	+6d.	5 9 1
Llanelly Elec.	21/–	17/–	5½	5½	18/–	+1/–	6 2 5
Lond. Assoc. Electric	21/–	12/6	7	5½	13/9	+6d.	—
London Electric	35/–	19/–	8	7	20/–	..	7 0 0
London Power Deb. Red.	105½	100	5	5	100½	..	4 19 6
Metropolitan	41/6	22/6	12	10	30/9	+9d.	6 10 0
Midland Counties	39/–	23/3	8	8	31/3	+6d.	5 2 5
Mid. Elec. Power	40/–	29/6	9	9	33/9	+⅛	5 6 8
Newcastle Elec.	29/9	22/6	7	7	22/6	..	6 7 3
North Eastern Elec.:							
Ordinary	31/6	16/6	7	7	23/9	..	5 18 0
7% Pref.	32/6	25/6	7	7	27/6	..	5 1 10
Northampton	44/–	38/–	10	10	38/9	..	5 3 3
Notting Hill 6% Pref. (£10)	10½	9	6	6	9	..	—
Northmet Power:							
Ordinary	42/3	22/6	10	10	30/9	+9d	—
6% Pref.	29/–	23/–	6	6	26/–	..	4 12 4
Richmond Elec.	24/6	18/–	7	6	18/9	..	—
Scottish Power	38/–	24/–	8	8	32/–	+9d.	5 0 0
Southern Areas	21/3	12/9	5	5	14/6	+9d.	6 18 0
South London	23/3	20/–	7	7	20/–	..	7 0 0
West Devon	20/–	17/6	5	5	20/–	..	5 0 0
West Glos.	22/–	15/–	2½	4½	16/3	..	5 10 10
Yorkshire Elec.	40/–	23/6	8	8	32/6	+1/9	4 18 6
Overseas Electricity Companies							
Atlas Elec.	4/–	1/3	Nil	Nil	1/9	..	—
Calcutta Elec.	37/–	22/6	10*	8*	30/6	..	5 5 0
Cawnpore Elec.	30/–	24/–	10	10	25/–	..	8 0 0
East African Power	25/6	19/6	7	7	20/9	+9d.	6 15 0
Jerusalem Elec.	24/–	15/–	7	7	17/6	+⅛	8 0 0
Kalgoorlie (10/–)	12/6	9/6	7½	7½	11/6	+6d.	6 10 5
Madras	26/9	21/6	8*	6*	25/–	..	—
Montreal Power	35½	30	1½	1½	32	..	—
Palestine Elec. "A"	25/–	10/–	5*	Nil	11/3	..	—
Perak Hydro-electric	20/3	13/–	2½	6	15/–	..	8 0 0
Shawinigan Power	27½	19	83cts.	90cts.	20	..	—
Tokyo Elec. 6%	69	52	6	6	30	..	20 0 0
Victoria Falls Power	75/9	56/6	15	15	68/9	+⅛	4 7 3
Whitehall Investments Pref.	17/9	8/–	7½	7½	10/–	..	15 0 0
Public Boards							
Central Electricity:							
1950–70	110½	104	5	5	107	+1½	4 11 9
1955–75	112½	106	5	5	109	+1½	4 11 9
1951–73	107½	102	4½	4½	105	..	4 5 9
1963–93	96½	90	3½	3½	92	+1	3 16 0
London Elec. Trans. Ltd.	92	87½	2½	2½	93	..	2 13 9
London & Home Counties							
1955–75	113½	105	4½	4½	105½	..	4 5 4
Lond. Passenger Transport:							
A	116	104	4½	4½	107	..	4 4 0
B	116	102½	5	5	104½	..	4 15 8
C	65½	25	1½	1½	29	+1	5 3 5
West Midlands Joint Elec.							
1948–68	106½	103	5	5	105½	..	4 14 9
Telegraph and Telephone							
American Tel. & Tel.	230	176	9	9	200	..	4 10 0
Anglo.-Am. Tel.:							
Pref.	107	85	6	6	96	..	6 5 0
Def.	23⅜	18	1½	1½	22½	..	6 13 4
Anglo-Portuguese	22/6	10/–	8	8	15/–	..	10 13 4
Cable & Wireless:							
5½% Pref.	99¾	66	4½	5½	92	+2	5 19 7
Ord.	65	27	4	4	55½	+2	7 4 4
Income	99¾	93	..	..	99	+½	4 0 10
Canadian Marconi $1	6/–	4/–	Nil	4cts.	4/6	..	—
Globe Tel. & Tel.:							
Ord.	32/6	21/6	7½*	6*	25/–	..	4 16 0
Pref.	27/9	22/6	6	6	23/9	..	5 1 1
Great Northern Tel. (£10)	20	11	20	20	12½	..	—
Inter. Tel. & Tel.	5½	2½	Nil	Nil	3½	..	—
Marconi-Marine	30/–	18/3	10	7½	20/–	..	7 10 0
Oriental Telephone Ord.	2⅞	45/–	12*	11½*	2⅜	..	4 16 10
Telephone Props.	15/–	11/–	5	6	11/3	−⅛	10 13 4
Telephone Rentals (5/–)	9/6	5/3	10	10	6/6	..	7 15 10

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price Nov. 25	Rise or Fall	Yield £ s. d.
Traction and Transport							
Anglo. Arg. Trams:							
First Pref. (£5)	4/3	1/–	Nil	Nil	2/–	..	—
4% Inc.	11½	2	Nil	Nil	9	+2	—
British Electric Traction:							
Def. Ord.	830	400	5	45	750	..	6 4 4
Pref. Ord.	169	130	8	8	140	..	5 14 3
Bristol Trams	48/6	32/6	10	8*	37/6	..	—
Brazil Traction	12½	5½	$1	50c.	5½	..	—
Calcutta Trams	24/–	16/3	8	5½	19/–	..	5 15 9
Cape Elec. Trams	18/6	16/–	5	5	17/–	..	5 17 8
Lancs Transport	35/–	27/6	10	10	35/–	..	5 14 3
Mexican Light:							
1st Bonds	36	25	5	5	35	..	—
Rio 5% Bonds	95	74	5	5	85	−5	5 17 8
Southern Rly.:							
5% Prefd.	79	35	5	5	45½	−1	10 9 10
5% Pref.	104½	59	5	5	82½	..	6 1 3
T. Tilling	45/9	29/–	10	10	40/–	..	5 0 0
Tilling & B.A.	47/6	41/9	9*	8*	44/6	..	—
West Riding	35/–	25/–	10	10	34/–	+6d.	5 17 8
Equipment and Manufacturing							
Aron Electricity Ord.	17/6	10/–	15	Nil	14/–	..	—
Assoc. Elec.:							
Ord.	43/3	26/6	10	10	40/–	+⅛	5 0 0
Pref.	36/6	32/3	8	8	35/–	..	4 11 5
Automatic Telephone & El.	47/3	32/–	12½	12½	37/6	..	6 13 4
Babcock & Wilcox	50/–	28/6	10	11	38/9	+6d.	5 14 2
British Aluminium Ord.	56/–	29/–	12½	12½	42/–	−6d.	—
British Insulated Ord.	92/6	67/–	20	20	81/3	+½	4 18 6
British Thermostat (5/–)	14/9	6/6	18½	18½	11/3	..	8 4 6
British Vacuum Cleaner (5/–)	12/–	4/9	40	12½	6/3	..	10 0 0
Brush Ord.	4/6	1/9	Nil	Nil	3/9	..	—
Callender's	69/–	46/–	15	15	60/–	+⅛	5 0 0
Chloride Elec. Storage	72/6	55/–	15	15	60/–	+½	5 0 0
Consolidated Signal	72/6	59/–	36½	17	60/–	..	5 13 4
Crabtree (10/–)	24/9	17/6	17½	17½	22/6	+½	7 15 7
Crompton Parkinson:							
Ord. (5/–)	20/–	12/–	30	20	17/6	+½	5 14 3
E. K. Cole (5/–)	5/–	2/6	10	Nil	4/6	+6d.	—
Elec. & Musical Industries (10/–)	10/3	4/3	5	Nil	7/9	+9d.	—
Electric Construction	36/3	27/6	13½	10	27/6	..	7 5 6
Enfield Cable Ord.	56/–	40/6	25	16½	45/–	..	7 5 5
Electrical Switchgear (10/–)	22/6	20/–	16	10	20/–	..	5 0 0
English Electric	33/9	16/6	10	10	28/9	+6d.	6 19 2
Ensign Lamps (5/–)	15/3	12/6	25	25	15/–	..	8 6 8
Ericsson Tel. (5/–)	39/3	23/–	25*	25*	27/6	+⅛	—
Ever Ready	28/3	16/6	30	40	25/6	..	7 16 10
Falk Stadelmann	18/3	12/6	6	7	13/9	..	10 3 8
Ferranti Pref.	25/–	22/–	7	7	23/9	..	5 18 0
G.E.C.:							
Pref.	32/6	26/–	6½	6½	30/–	..	4 6 8
Ord.	83/3	53/–	20	20	77/–	+⅛	5 4 0
Greenwood & Batley	25/6	20/–	15	15	20/–	..	13 0 0
Hall Telephone (10/–)	18/6	8/9	15	10	11/3	..	8 18 0
Henley's (5/–)	21/6	12/6	20	20	18/9	..	5 6 8
4½% Pref.	21/2	20/6	4½	4½	21/3	..	4 4 8
Hopkinsons	46/9	32/6	12½	15	38/9	..	7 14 10
India-Rubber Pref.	21/–	19/6	5½	5½	20/–	..	5 10 0
Intl. Combustion	121/3	70/–	32½	32½	44½	−½	7 17 9
J. Lucas	60/6	40/–	15	15	48/9	..	6 3 4
Johnson & Phillips	50/9	32/6	12½	15	45/–	+½	6 13 4
Lancashire Dynamo	59/9	47/6	25	20	47/6	..	8 8 5
Laurence Scott (5/–)	11/–	6/–	15	15	7/–	−1/–	10 14 2
London Elec. Wire	25/6	20/–	7½	7½	22/6	..	6 13 4
Mather & Platt	46/6	30/–	13½	10	35/–	+⅛	5 14 3
Metropolitan Elec. Cable Pf.	22/–	21/3	5½	5½	21/3	..	5 3 6
Murex	86/9	52/6	20	20	77/6	+⅛	5 3 3
Pye Deferred (5/–)	9/–	6/9	25	25	8/9	..	14 5 8
Revo (10/–)	20/9	11/6	17½	5	17/6	..	2 17 6
Reyrolle	60/6	41/–	12½	12½	46/3	..	5 8 2
Siemens Ord.	23/9	15/6	7½	7½	17/6	+⅛	8 11 6
Strand Elec. (5/–)	2/3	9d.	10	4	1/3	..	16 0 0
S. Smith (1/–)	8/–	3/6	37½	50	7/6	..	6 13 4
Switchgear & Cowans (5/–)	11/9	5/6	20	10	7/6	+6d.	6 13 4
Telegraph Condenser (10/–)	8/9	6/3	5	..	7/6	..	—
Telegraph Construction	42/6	29/–	10	10	33/9	+⅛	5 18 6
Telephone Mfg. (5/–)	9/–	5/–	9	9	6/–	..	7 10 0
Tube Investments	96/9	59/–	23⅜	23⅜	85/–	+⅛	5 12 0
Vactric (5/–)	3/6	2/–	4	Nil	2/3	..	—
Vickers (10/–)	22/–	9/6	10	10	14/6	..	6 18 0
Ward & Goldstone (5/–)	19/9	12/6	20	20	12/6	..	8 0 0
Westinghouse Brake	46/–	30/6	17½	10	33/9	..	5 18 6
Walsall Conduits (4/–)	26/6	17/6	55	55	23/9	..	9 5 0
West, Allen (5/–)	7/–	3/–	7½	10	3/9	..	10 0 0

* Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Great George Street, London, S.W.1.

Aldershot.—Emergency pumping plant at sewage works; borough engineer, Council Offices, Grosvenor Road, Aldershot.

Birmingham.—December 3rd. Salvage Department. 150-kVA transformer, glass-bulb rectifier and cables with necessary alteration to the main switchboard. Specifications from general manager, Salvage Department, 161, Corporation Street (deposit £1 1s.) Tenders to the Town Clerk's office (Room 1), the Council House.

Ebbw Vale.—November 29th. Electricity Department. H.v. and pilot cables, sub-station switchgear and transformers. (November 8th.)

Easthampstead.—December 5th. U.D.C. Automatically controlled electrically operated wet sump vertical sewage pumping unit. Particulars, specification and form of tender from the consulting engineers, Howard Humphreys & Sons, 7, Eldon Square, Reading. (Deposit: £2 2s.) Tenders to D. H. M. Saunders, clerk, Council Offices, Bracknell, Berks.

New Zealand. — WELLINGTON. — Public Works Department. January 14th. Two 3,000-kVA, 11-kV, three-phase, 50-cycle outdoor-type voltage regulating transformers and control equipment. (T.22238/40.)*

December 10th. One 2,250-kVA, 11 kV transformer for the Kiri substation, and two for Winton substation. (T.22551/40.)*

South Africa.—PRETORIA.—Union Tender & Supplies Board. December 12th. Electric light fittings for G.P.O. (T.22426/40.)*

January 4th. Plant at Gasworks, Cottesloe: (a) One 200-kW rotary convertor and associated equipment. Alternatively (b) one 200-kW mercury arc rectifier or (c) two 100-kW mercury arc rectifiers. (d) Equipment for spare power circuit frame. (T. 22424/40.)*

Wolverhampton. — December 3rd. West Midlands Joint Electricity Authority. High- and low-voltage AC cables and low-voltage DC cables. (November 8th.)

Orders Placed

Colchester.—Electricity Supply Committee. Recommended. 11,000-V switchboard (£11,976).—G.E.C.

Darlington.—Town Council. Accepted. Switchgear (£340).—A. Reyrolle & Co.

Fort William.—Lighting Committee. Accepted. Stand-by alternator.—Metropolitan-Vickers Electrical Co.

Glasgow.—Gas Committee. Accepted. Automatic air compressor set, including driving motor and air receiver (£102).—Westinghouse Brake & Signal Co.

Cleansing Committee. Accepted. Supply of twelve batteries (£2,838). — Tudor Accumulator Co.

London.—METROPOLITAN WATER BOARD. Accepted. Electrical work in connection with change-over to AC at Battersea Works (£737).—Colston Electrical Co., Ltd. (In place of tender previously accepted.)

ISLINGTON.—Electricity Committee. Accepted. Battery repairs (£195).—Tudor Accumulator Co.

Luton.—Education Committee. Accepted. Electric light installation at new technical college (£883).—Shoolbred Electrical Co., Ltd.

Northumberland.—County Council. Accepted. Electric lighting of shelters in the Berwick area (£295).—A. R. Hudson.

Peterborough.—Electricity Committee. Accepted. Switchgear (£480 and £142).—Ferguson, Pailin, Ltd. Switch cubicle (£165).—English Electric Co.

Sheffield.—Town Council. Accepted. Electric potato-peeling machine (£60).—Mabbott & Co., Ltd., Manchester.

Spilsby.—Rural Council. Accepted. Installation of electric pumps and equipment at Mumby borehole (£2,021).—Harland Engineering Co., Ltd.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and tenders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Amesbury. — Fire station; surveyor, Council offices, Amesbury.

Ancoats. — Additions, Ancoats Works, Sandford Street; David Moseley & Sons, Ltd., Ardwick.

Ashton-under-Lyne.—Conversion of Town Hall boilerhouse to police mess-room, &c., for T.C.; town clerk, Town Hall, Ashton.

Barnsley.—Underground shelters, near Town Hall; borough surveyor.

Belper.—Construction of buildings in connection with chlorination of water supplies, for U.D.C.; G. and F. W. Hodson, engineers, Bank Chambers, Loughborough.

Berden.—Conversion, Berden Hall for mental defectives; Essex county architect.

Birkenhead. — Auxiliary fire station; borough engineer, Town Hall.

Birmingham.—Shelters at Acocks Green and Bordesley Green Council Schools; city engineer, The Council House.

Bristol.—Clinic accommodation (£4,843), for T.C.; borough engineer, 63, Queen Street, Bristol.

Burntisland.—Canteen, Rossend; Burntisland Shipbuilding Co., Ltd.

Caernarvonshire.—Public shelters, Nevin, Llanbedrog, Abersoch, &c.; county architect, Caernarvon.

Chorley (Lancs).—Wards at Maternity Unit, Chorley and District Hospital; secretary to the Committee.

Clayton (Manchester.—Pump room, office, &c.; Clayton Aniline Co., Ltd.

Coleshill.—Cleansing station (£810); Warwickshire county architect.

Financial Section (*Concluded from page 94*).

Last year they generated 270 million kWh as compared with 113 million kWh in 1938-39. Of this total, the steam stations supplied nearly 140 million kWh, as compared with only 250,000 kWh, and the hydro-electric stations 130 million kWh as compared with 113 millions in the previous year. Sales of electricity totalled 235.2 million kWh, as compared with 94.2 million kWh a year before. The maximum load on the power station was 48,600 kW, as compared with 27,800 kW in the previous year. The average Malayan tin quota over the financial year was 79 per cent., which compared with 31.6 per cent., for the previous year, and it was worth noting that the percentage rise in the quota was about the same as the percentage rise in gross revenue.

The Tata Hydro-Electric Power Supply Co. reports a revenue from power sales for the year to June 30 of Rs. 33,79,808, as compared with Rs. 34,05,839 for the preceding year, and from other sources Rs. 14,64,645 (against Rs. 15,21,249). The net profit was Rs. 29,72,950 (Rs. 28,24,423). From this are deducted staff bonus Rs. 35,000, writing down conversion bonus and debenture expenses Rs. 80,577, transfer to general reserve Rs. 3,50,000, special repairs Rs. 34,503 and tax Rs. 5,00,000. The final ordinary dividend is Rs. 4.8 per share, making Rs. 8.8, tax free, for the year and Rs. 2,56,618 is carried forward (against Rs. 2,58,708 brought in).

The Andhra Valley Power Supply Co. reports a revenue to June 30th of Rs. 45,73,535 from power sales (against Rs. 48,68,387 for 1938-39), and income from other sources of Rs. 2,54,479 (against Rs. 1,78,049). The net profit is Rs. 22,38,125 (Rs. 21,15,617). The final ordinary dividend is Rs. 45, making Rs. 75 per share, tax free, for the year, and Rs. 3,75,191 is carried forward (against Rs. 3,84,819 brought in).

The Tata Power Co., reports a revenue for the year to June 30th from power sales of Rs. 75,19,893, as compared with Rs. 88,64,289 for the preceding year, and from other sources Rs. 3,69,290 (against Rs. 3,44,389). The net profit is Rs. 38,51,064 (Rs. 46,84,105), and after making various allocations, it is proposed to pay a final ordinary dividend of Rs. 40, making Rs. 65 for the year (against Rs. 75, including Rs. 10 bonus). The balance carried forward is Rs. 5,42,788 (against Rs. 4,81,839 brought in).

Vactric, Ltd., has deferred the dividend on the cumulative preference shares due on December 1st. The dividend on £87,529 preference capital is in arrears as from October 1st, 1933

The Marconi International Marine Communication Co., Ltd. is maintaining its interim dividend at 2½ per cent., less tax.

Drake & Gorham, Ltd., have declared a first and final dividend of 2 per cent. (against nil).

The Chloride Electrical Storage Co., Ltd., is again paying an interim dividend of 5 per cent.

The Southern Areas Electric Corporation, Ltd., announces that the question of an interim dividend has been deferred until the end of the financial year. For 1939 an interim of 2 per cent. was paid, which was followed by a final dividend of 3 per cent.

Colne.—Fire station; borough surveyor, Town Hall.

Consett, Co. Durham.—Mortuary; T. P. Leath, U.D.C. offices, Blackhill, Co. Durham, surveyor and architect.

Conversion of premises for ambulance transport depot; T. P. Leath.

Coventry.—Elementary school, Stivichall Hall Estate; D. E. E. Gibson, city architect, 1a, Warwick Row.

164 houses, Canley Estate, for Housing Committee; A. H. Coltman & Son, 143, Barker Butts Lane; T. Bates & Son (Coventry), Ltd., 51, Warwick Street.

Croydon. — Extensions to Mayday Hospital; borough engineer, Town Hall, Croydon.

Darlington.—Extensions to works for J. Tinsley, Ltd., Neasham Road; staff architect.

Desborough.—Four public shelters; A. Harris, surveyor, Council Offices, Desborough, near Kettering.

Devon.—Youth service centre, Brixham, for E.C.; H. V. de Courcy Hague, county architect, Heavitree Road, Exeter.

Dewsbury.—Erection of feeding centre at Thornhill Council School; borough architect and buildings surveyor, Town Hall, Dewsbury.

Durham.—Adaptation of 199 houses, Bear Park district; S. Dodds, surveyor, Rural Council offices, Byland Lodge, Hawthorn Terrace, Durham City.

Storehouse and X-ray plant at Earl's House Sanatorium; new premises for maternity centre; heating and storage improvements, Seaham Hall Sanatorium; and renovations at Holywood Hall and Seaham Hall; county surveyor, 43, Old Elvet, Durham.

Epsom and Ewell.—Public surface shelters (3,000 persons); borough engineer, Town Hall, The Parade, Epsom.

Essex.—Accommodation for Homeless (£23,000); county architect.

Fife.—Police station, Auchtermuchty; extensions to constabulary headquarters at Cupar; and adaptation of house at Falkland as office and residence; county clerk, County Buildings, Cupar.

Glasgow.—Additions to factory for Greenlees & Sons Ltd., Bardowie Street; J. B. Wilson & Honeyman, architects, 92 Bath Street.

Kent.—Completion of Leybourne Grange colony (£240,000); county architect.

Kidlington.—24 Houses, Hazel Crescent, Stratfield Brake Estate, 16 houses, Oxford Road, and three shops, TheParade, Oxford Road; Taylor Woodrow Estates, Ltd., Oxford Road, Kidlington.

Leicester.—Public shelters at playing fields and clinics; city engineer, Shirehall.

Lenham.—Sleeping accommodation at Sanatorium (£3,315); Kent county architect.

Liverpool.—Renovation works at Sefton Park Library (£1,500); city engineer, Municipal Offices, Dale Street.

Lochgelly (Fife).—51 communal shelters (2,424 persons); Burgh Surveyor.

Long Eaton.—Sewage disposal works extensions; J. Quinn & Son, 28, Turney Street, Nottingham.

London.—ST. PANCRAS.—Basement shelter extensions (£2,267), King's Cross Coaching Station, for B.C. Emergency Committee; borough engineer, Euston Road, N.W.1.

Lunesdale.—Booster pumphouse, for water scheme, for Rural District Council; A. R. Harlow, clerk, Council Offices, Hornby, nr. Lancaster.

Maldon.—Shelters (£5,000), with fittings (£5,500), for T.C.; borough engineer, Council Offices, High Street, Maldon.

Morecambe and Heysham.—Conversion of Pedder Street Methodist Church as electricity showroom, for Town Council; borough engineer, Town Hall, Marine Road East, Morecambe.

111 public shelters; borough surveyor, Town Hall.

Newcastle-on-Tyne. — Communal feeding centres (£2,350); city engineer, Town Hall.

Reconstruction of premises at the Phœnix Mills for the City Council (£3,000); city estate and property surveyor, Town Hall.

North Riding.—Shelters at schools at Guisborough; county architect, County Hall, Northallerton.

Northumberland.—School shelters (£5,653), for C.C.; W. W. Tasker, county architect, County Offices, Morpeth.

Portsmouth. — Three workshops extensions; J. Evans & Son (Portsmouth), Ltd., Goldsmith Avenue, Southsea.

Yeast drying plant building, for Brickwood & Co., Ltd.; Frank J. Privett, Ltd., contractors, Cottage Grove, Southsea.

Redditch.—176 houses, Greenlands Estate; L. O. Wilkes, surveyor, Council House, Redditch.

Rochester.—Conversion of Castle Hall into police station, for T.C.; town clerk, Guildhall, Rochester.

Sheffield.—First section of new College of Art and Technology, Arundel Street; city architect.

Shropshire. — Sergeant's residence and office, Donnington (£2,000), for C.C.; county architect, 5, Belmont, Shrewsbury.

Speke.—Mission for Church of Christopher; Rev. Fr. James MacCarthy, P.P., The Presbytery, Speke Estate, Liverpool.

Staffordshire.—Shelters at Betley, Coven and Tean Schools, for E.C.; K. L. Murray, county architect, County Buildings, Stafford.

Stretford.—Works additions, Old Trafford; Major Robinson & Co., Ltd.

Stroud.—Fire station (£17,691), for T.C.; Gee, Walker, & Slater, Ltd., contractors, 3 Fitzmaurice Place, London, W.1.

Swanley.—Alterations, Alexandra Hospital (£7,000); Kent county architect.

Swinton and Pendlebury. — Communal shelters on 22 additional sites; borough surveyor, Town Hall, Swinton, Lancs.

Wakefield.—Cleansing and rescue party depot; G. Crook & Son, Ltd., builders, Henry Street.

Bank: Martins Bank, Ltd., Westgate.

Warrington.—Works canteen; Warrington Tube Co., Ltd.

Public communal shelters on Bewsey Estate; borough surveyor, Municipal Buildings.

Wellington (Salop).—Junior and Infants' School, Donnington Wood; Diocese of Shrewsbury, Council House, Shrewsbury.

West Hartlepool.—Shelter, Chatham Road, for the Hartlepools Co-operative Society; staff architect.

Wigan.—Fire station; borough engineer, Library Street, Wigan.

Wolverhampton.—Mortuary; S. J. Smith & Co. (Bidford), Ltd., 205, Corporation Street, Birmingham, 4.

Workington.—Extensions to fire stations; borough surveyor, Town Hall.

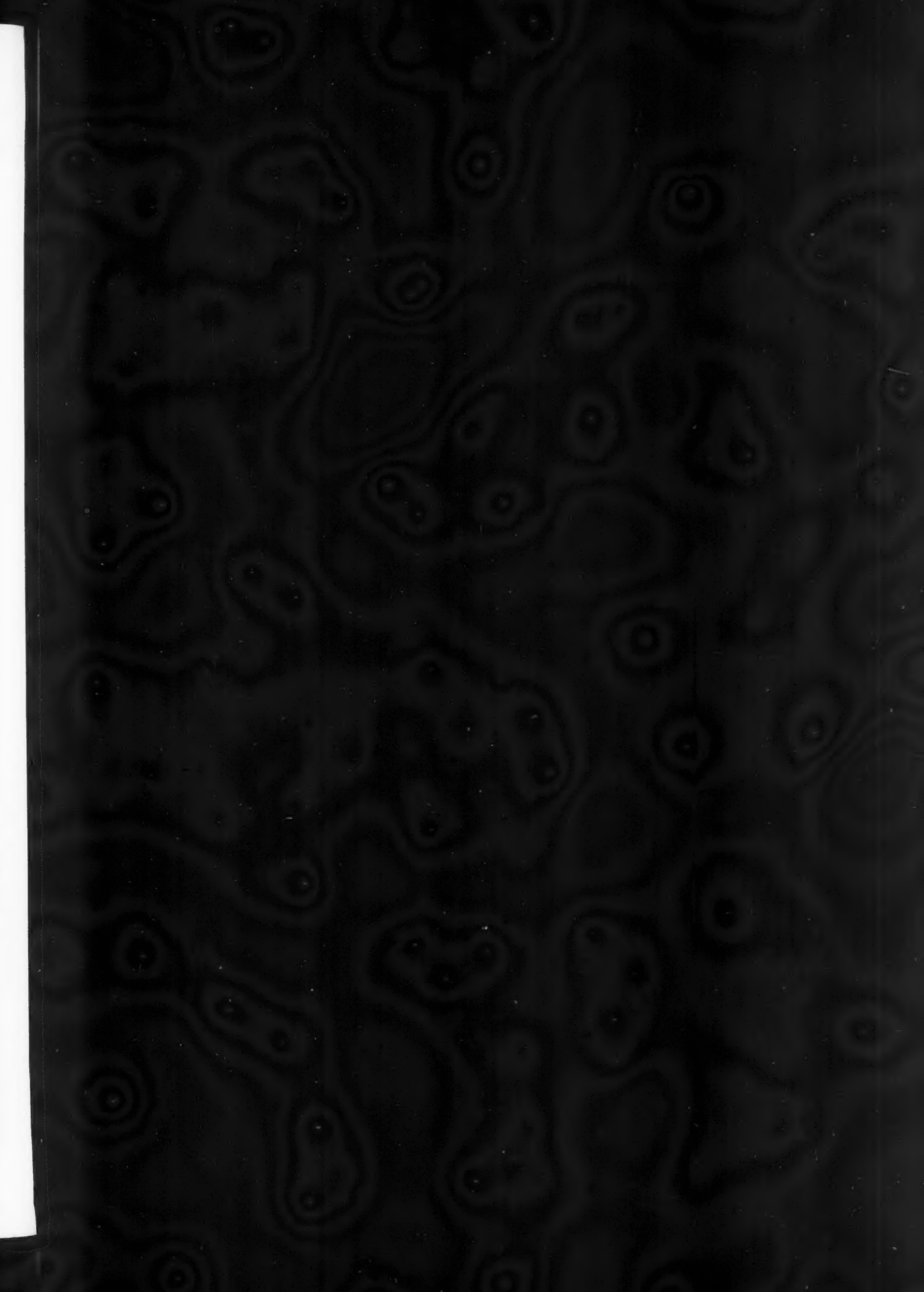
Factory bakehouse; E. Jarman, pork butcher, 42, Wilson Street.

Wrexham.—Extensions to public abattoir, for Borough Council; town clerk, Guildhall, Wrexham.

U.S. Firms' Wartime Activity

OUR New York Correspondent says that the enormous strides being made today by United States industries in expansion of armament building capacity are dependent in considerable measure upon the great electrical equipment manufacturers. These enterprises are themselves expanding steadily and, in the case of General Electric Co., building many products that are not distinctly or exclusively electrical. Some £10,000,000 is being expended by this company alone for increased manufacturing facilities and the variety of war products, in addition to customary peacetime goods such as electric cookers, refrigerators and other items, is amazing.

A list of war products now being manufactured has just been disclosed by the management to the stockholders. It includes naval gun mounts and projectile hoists; electric drives for submarines and tanks; turbines for ship propulsion, delivering in certain cases more than 50,000 HP; and reduction gears up to 18 ft. in diameter weighing as much as 70,000 lb. There are also electric and hydraulic devices for maintaining naval guns and searchlights at the required position regardless of sea conditions, and instruments for indicating these positions at remote points. There is an important and large production of searchlights for anti-aircraft and other purposes. There is also radio transmitting and receiving apparatus; anti-aircraft lighting systems; turbo-superchargers for aircraft; electrical generators, said to be of revolutionary design and greatly improved efficiency; propeller pitch control devices; gun control equipment; and 75 mm. howitzers. These products are, of course, in addition to general products such as wire and cable, motors, lamps, switchgear, control instruments and other standard products.

The G.E. Company has formed its own Defence Co-ordinating Committee to speed up all war work. The committee organised facilities so that all national defence and export war orders were started promptly and it works on the solution of difficult production problems which are continually arising. Although the company has the largest turbine capacity of any American company, it had to take immediate steps to expand, for mass-production methods could not be applied to the manufacture of turbines and the only solution was more space, more machine-tools and more skilled men. In skilled men, the training courses customarily operated by the company for graduates of high schools and trade schools to learn branches of electrical manufacture have for some time been expanded nearly 50 per cent. and the Apprentice Course this year will produce a much larger than normal number of machinists, tool makers, draughtsmen and other skilled men.

The Electrical World reports that the Westinghouse steam division works at Lester, near Philadelphia, is to expand its present facilities at a cost of more than $9,500,000, to ensure delivery on time of turbines for forty-five fighting ships of the Navy. Recent contracts have totalled more than $64,500,000. In addition to the Navy equipment, land turbines and ship propulsion apparatus for the merchant marine are included. This machinery will total about 5,000,000 HP, of which 3,000,000 HP will be used to drive the Navy ships.